

modern machine shop

JUNE 1961

**ELECTRO-CHEMICAL
MACHINING OF
REFRACTORY ALLOYS**

See Page 102

**DRILLING CLOSE
TOLERANCE HOLES**

See Page 136

The MAGAZINE for PRODUCTION EXECUTIVES in METALWORKING PLANTS

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about it...



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UNIVERSAL GRINDING

Reversing the Cost Trend

by Clifford G. Menard

Consulting Engineer
The Heald Machine Company

Just about everything costs *more* these days — *much* more than it did 10 or 15 years ago. And when we first decided to build a completely new Universal Internal Grinding Machine that would actually *reverse* the upward cost trend, many an eyebrow was lifted in disbelief.

Admittedly, the task was not a simple one. In order to cut costs without cutting quality, we had to make a complete re-evaluation not only of the basic machine design, but of every step of our manufacturing operations as well. But we found that a large number of cost savings could be made, by utilizing the latest advances in machine design and streamlining production methods.

This better, more versatile general purpose grinder costs about *half* as much as comparable machines today, and *less* than similar machines (with fewer features) cost in 1947!

Here's how some of the savings were made. Hydrostatic table ways eliminated an expensive booster arrangement in the hand table feed. An externally-mounted valve "package" simplified the hydraulic power arrangement. And with all hydraulics outside of the machine, the base is mechanically stronger and less expensive to produce. Furthermore, simplified basic engineering and construction make it possible to build this standard machine on a STOCK basis resulting in shorter deliveries.

These and other refinements enabled us to make the 273A a truly universal machine with greater capacity, easier operation, and inherent precision that holds tolerances within .0001" in normal production and .000050" in special cases. Yet its 1947 price tag puts it within the economic reach of virtually every plant or machine shop, regardless of size.

Here's the new Model 273A Universal, on display at the 1960 Machine Tool Exposition. On a steel test piece, the O.D., a straight bore, a tapered bore and the face were ground to size within .0001" at a single chucking.



Workhead swivel of 90°, several wheelhead positions, permit I.D., O.D. and rotary surface grinding of parts up to 12" in diameter. Vari-speed workhead drive is infinitely adjustable from 75 to 450 rpm.

Ask your Heald Engineer for the complete UNIVERSAL story. Then compare its performance and cost with any other similar machine available today!

THE HEALD MACHINE COMPANY

Subsidiary of The Cincinnati Milling Machine Co.

Worcester 6, Massachusetts

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modern machine shop

For Production Executives

Vol. 34, No. 1, June, 1961

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A STATEMENT OF POLICY—The principal function of MODERN MACHINE SHOP is to search out and disseminate the best and newest ideas for advancement of engineering skill and mechanical efficiency in the metalworking industry and neither effort nor expense is spared in the performance of this task.

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modern machine shop

JUNE 1961

VOL. 34 NO. 1

features

page

► 102 **ELECTRO-CHEMICAL MACHINING
OF REFRACTORY ALLOYS**

By W. B. Stephenson, Jr.

The author, who is associated with the Manufacturing Engineering Research Laboratory of the General Electric Company, discusses in detail a fast, precise method for removing metal in producing a combination blade and bucket airfoil for a by-pass control test vehicle. Outlined are the various steps followed in producing these alloy "buckets," with a large number of illustrations supplementing the text.



► 110 **WHAT'S THE JOB OF A
NUMERICAL CONTROL PROGRAMMER?**

By Harry Ankeney

Of all the people who could rightly be held responsible for the success of a numerically controlled operation, the programmer is the most important link in the chain from the designer to the finished product. In this presentation, the author explains the role of this most important individual—the programmer—in any application of numerical control.

► 118 **MACHINING MISSILE PARTS
TO TOLERANCES OF 25 MILLIONTHS**

By Gilbert C. Close

In a new environmental-controlled cleanroom, specifically designed, built and equipped for super-precision machine operations at the Nortronics Division of Northrop Corporation, Anaheim, California, tolerances down to 25 millionths of an inch on parts up to 4 inches in diameter are being consistently maintained.

in this issue

page

► 124 ACCOUNTING FOR TIME

By Carl K. Gieringer

As pointed out by the author, the time clock, long a basic device for securing weekly payroll data, is becoming a more useful tool in obtaining up-to-date information. And its companion, the time card, is being adapted to meet new needs. As a combination, the clock and card are providing a method of securing facts often without a heavy investment in additional office equipment.

► 132 DIE FORMS FEATHER-EDGED CUP WASHER

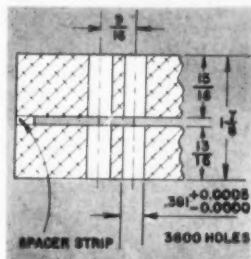
By L. Kasper

Construction and operating details are presented regarding a unique die that is designed to form a shallow steel cup washer on which the edges of the cup are feathered to a sharp edge in the forming operation. This washer is driven into a wooden part which is bolted to mating wooden part, the purpose being to prevent wood to wood contact so that easy swiveling of one part on the other is possible.

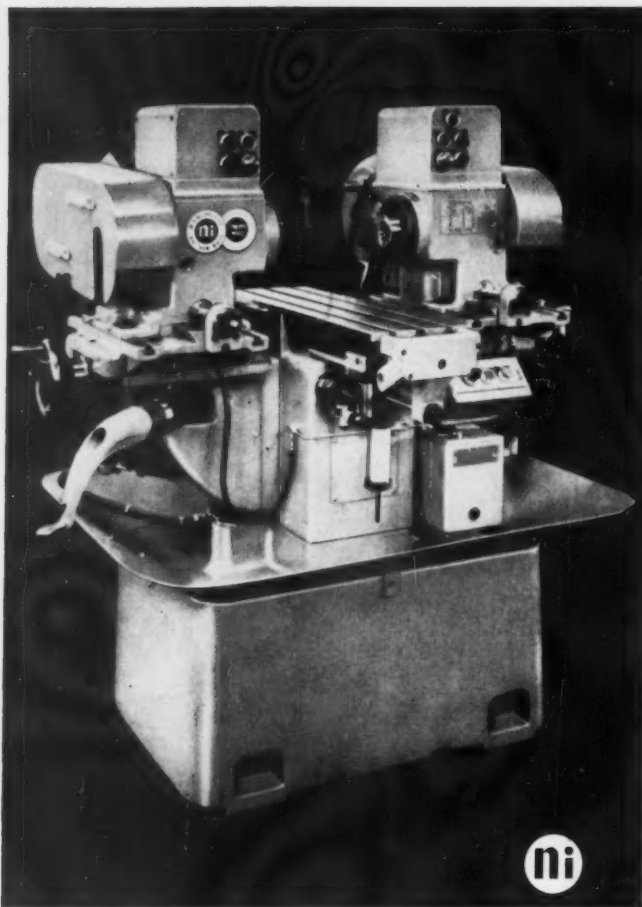
► 136 DRILLING CLOSE TOLERANCE HIGH FINISH HOLES

By C. B. Weidner

For sheer preponderance of holes, nothing can equal condenser or heat exchanger tube sheets. In this article, the author describes a method which is designed to reduce drill breakage to a minimum in the drilling of tube sheet assemblies. Several line sketches augment the text to provide a clearer understanding of the various drilling operations which are performed.



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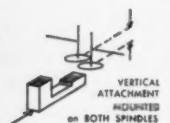
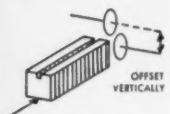
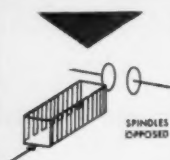
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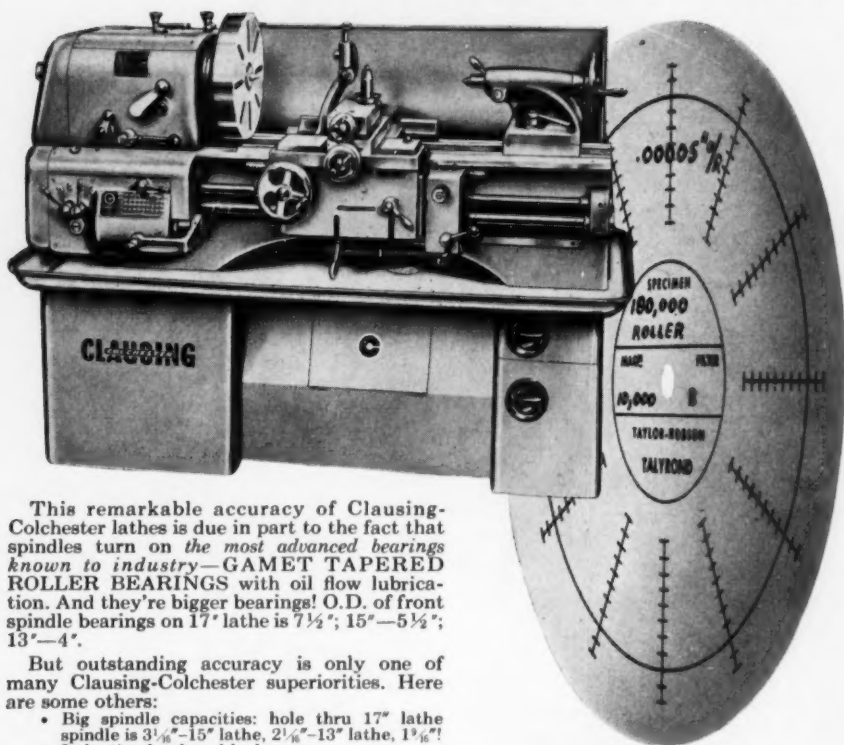


AT THIS
LOW COST

\$7,830

Base price standard
motor driven model,
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CLAUSING COLCHESTER GEARED-HEAD LATHES *turn ROUND within .0001"*



This remarkable accuracy of Clausing-Colchester lathes is due in part to the fact that spindles turn on the most advanced bearings known to industry—GAMET TAPERED ROLLER BEARINGS with oil flow lubrication. And they're bigger bearings! O.D. of front spindle bearings on 17" lathe is 7½"; 15"—5½"; 13"—4".

But outstanding accuracy is only one of many Clausing-Colchester superiorities. Here are some others:

- Big spindle capacities: hole thru 17" lathe spindle is 3¼"—15" lathe, 2¼"—13" lathe, 1½"!
- Induction-hardened bed ways.
- All-geared headstock.
- Oil bath lubricated headstock and quick-change gear box.
- Separate feed rod for power feeds.

Best of all, Clausing-Colchesters are the greatest lathe values you'll find anywhere. Prices for the 13" straight bed model start at \$2440; 15"—\$3415; 17"—\$5100. Prices include motor and magnetic controls. Gap bed and profiling lathes available in all three sizes.

Get ALL the facts. Write for descriptive literature on the "Greatest Buys in Lathe History!"

POSITIVE PROOF!

Every Clausing-Colchester must turn round within .0001". Accuracy is checked by inspecting a turned work piece on a Talyrond which measures and records in millionths on a graph like the above. Work piece and graph are supplied with each lathe as proof of its superior accuracy.

356

CLAUSING

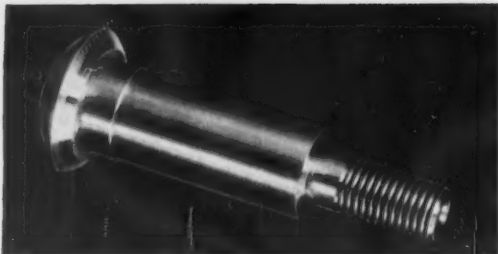
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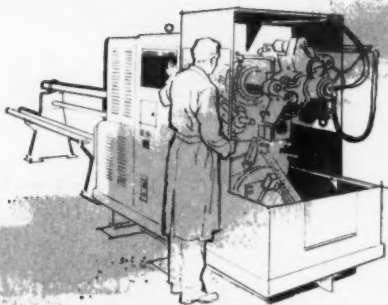


For Deep Cuts With A Heavy Feed. The 2AB with its exclusive Single Cutter Turner is the only bar automatic that can hog metal like this. The part shown is machined from 2" C-1141 annealed bar stock. The 1 1/4" diameter is held to a .001" tolerance and 25 micro-inch finish in one cut!

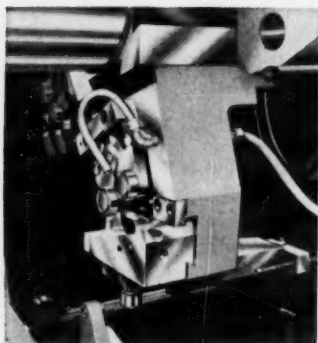
- Speed is 908 r.p.m. or 476 s.f.m.
- Feed is .024" per revolution
- Depth of cut, 3/8" • Length of cut, 4 1/2"
- Power consumed, 30 H.P.

And this cut is accomplished in 13 seconds!

NEW IDEA IN BAR AUTOMATICS



Warner & Swasey's 3" Single Spindle Bar Automatic features roller bar turners!



The cutter in the roller bar turner is automatically relieved at the end of the cut, eliminating cutter withdrawal marks and lengthening cutter life. The tool is automatically reset by a cam in an off-index position.

Deep cuts at heavy feeds plus burnished surfaces and better size control are the result of using turret lathe-type roller bar turners

The 2AB Bar Automatic utilizes the rugged overhead turret design made famous in hundreds of shops by the extensive line of Warner & Swasey "AC" chucking automatics. The overhead turret provides ample tool clearances for tool indexing and for advancing the heavy duty bar turner close-up to the collet. Thus, a major limitation of most large bar automatics is overcome, and the tested advantages of "roller turning" are now available to users of single spindle bar automatics.

Ask a Warner & Swasey Field Engineer for details on how this productive automatic can handle your bar jobs. Warner & Swasey Company, Cleveland 3, Ohio.

**YOU CAN TURN IT BETTER, FASTER,
FOR LESS...WITH A WARNER & SWASEY**



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• Depth of cut, $\frac{3}{4}$ " • Length of cut, $4\frac{1}{2}$ "
• Power consumed, 30 H.P.
And this cut is accomplished in 13 seconds!

Cut metal cleaning costs with blasting



Pressure blasting with Norton ARROW-BLAST abrasive will save money every step of the way on most of your metal cleaning jobs — because of the high cutting efficiency and longer life of ARROW-BLAST grain. Composed of fused alumina grains that are tough, hard and sharp, ARROW-BLAST abrasive has high resistance to breakdown so that it can be used repeatedly through several cleaning operations. And unlike sandblasting, dust is negligible with ARROW-BLAST abrasive eliminating poor visibility and other operator hazards.

Norton NORBIDE* pressure blast nozzles add even more to the savings picture. Molded of boron carbide, the man-made material that's next to diamond in hardness, these nozzles have proven over and over that they have much lower

overall operating cost than so-called "inexpensive" nozzles. NORBIDE nozzles cut costs right down the line — in replacement . . . operator downtime . . . air consumption.

An informative new report from Norton entitled "Pressure Blasting with Manufactured Abrasives," gives many details and operating facts about this efficient and economical metal cleaning process. For your copy, write NORTON COMPANY, General Offices, Worcester 6, Massachusetts.

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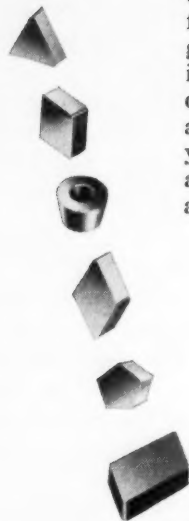
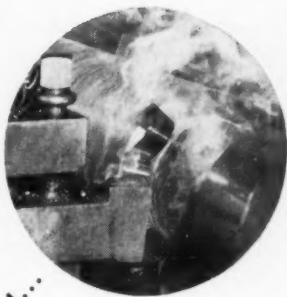
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FIRST CHOICE of more and more plants

Whether you're machining steel, cast iron, non-ferrous metals or superalloys — whether you're making short or long runs, there's a V-R throw-away insert in the size and shape that's best for your job. Then, too, fifteen carbide grades, plus a ceramic grade, cover the widest possible range of applications. V-R inserts, used with V-R toolholders and face mill cutters, eliminate tool grinding costs, reduce carbide inventory and lessen machine downtime because of fast, accurate indexing. Ask your V-R representative about V-R throw-away inserts.



...V-R INSERTS... BETTER FROM START TO FINISH...



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June, 1961

MODERN MACHINE SHOP 9

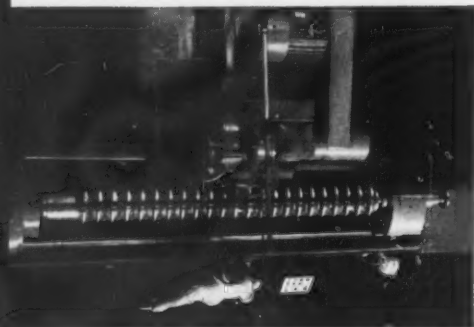
CINCINNATI

FILMATIC PLAIN GRINDER saves up to **35** hours in grinding hard-surfaced mixing screw

AT THE RIGHT you see a rough, tough part. It's rough because it has been hard-surfaced by welding. It's tough because, until recently, it taxed the ingenuity of manufacturing engineers to machine it.

The part is a 16" OD mixing screw, manufactured by a prominent builder of food and chemical machinery. Their problem was to machine the OD of the flights to a smooth finish and at a reasonable cost. Turning operations on a lathe required 35 to 45 hours. Too expensive. Now, the OD is *ground* in 10 to 15 hours! A CINCINNATI FILMATIC 24" x 120" Plain Grinding Machine performs the operation, reducing cost by more than half. And, finish is of much higher quality than ever before.

All CINCINNATI Centertype Grinding Machines are built to operate at the highest standards of performance. Generously proportioned structural elements are one plus factor. Another is the dependable pressure lubricating system for the ways. And still another is the FILMATIC bearing mounting for the grinding wheel spindle... no adjustment ever required for extreme variables in stock removal. More information on CINCINNATI FILMATIC Plain and Roll Grinding Machines in the heavy duty sizes may be obtained by writing for Catalog G-709-1.



Tops in grinding heavy, hard stock and large work. It's easy for this new CINCINNATI FILMATIC 24" x 120" Plain Grinder. Catalog G-709-1.



Photographs courtesy of Baker Perkins, Inc., Saginaw, Mich.



Huge savings in time are gained by replacing turning with grinding to remove hard, heavy stock on the OD of mixing screws. A CINCINNATI 24" x 120" Plain Grinder performs the operation, grinding the rough, interrupted surfaces to a high-quality finish.



• ROLL • CHUCKING • CENTERLESS LAPPING

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GRINDING MACHINE DIVISION

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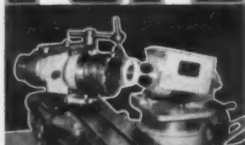
For Profitable Production of Accurate Parts

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POPE

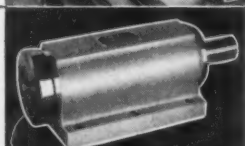
PRECISION SPINDLES

GRINDING



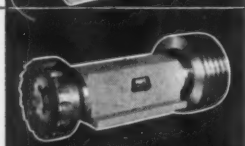
pictured is Pope P-6651-B Motorized Super-Precision Tilting Head for No. 2 Cincinnati Tool and Cutter Grinders. It is but one of hundreds of different Pope Grinding Spindles — motorized, belt driven, external, internal, deep hole, etc.

BORING



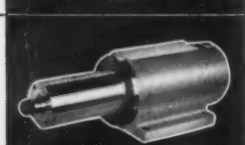
shown is Pope P-18501B Heavy Duty, Flange Nose, Belt Driven Precision Spindle for large deep hole boring and facing tools. Others include multi-spindle boring heads, motorized and motorized-belt driven high speed heads and super-precision heads for boring holes round.

MILLING



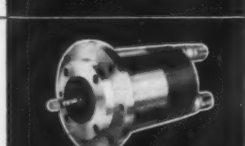
this Pope P-12007-M50 Heavy Duty, Belt Driven Spindle is available in sizes from 1 to 50 HP with standard No. 10, 20, 34, 40, 50 or 60 milling machine noses. (Ask for Bulletin S-17.) Other milling spindles include motor driven, gear hobbing, tracing attachment, right angle and offset types.

GRINDING MILLING DRILLING CUTTING



this Pope P-1029-AU Motorized, Heavy Duty Spindle is available from 900 to 3600 RPM and up to 20 HP. Shaft can be arranged to hold grinding wheels, milling cutters, drills or other cutting tools. Quick-change collet chucks are used for drilling, universal collet chucks for end milling.

HIGH FREQUENCY



this Pope P-940 Motorized, Water Cooled, Oil Mist Lubricated, Grinding Spindle runs at 100,000 RPM, features low maintenance cost. Other heavy duty, high cycle Spindles at lower speeds are available for milling and other operations, and for mounting in a horizontal or vertical position.

ANOCUT ELECTROLYTIC GRINDING



this Pope P-19162-AN Spindle has built-in insulation and rugged fork type cool operating brush assembly for transmitting low voltage high amperage current to wheel. Others include belt driven types and are arranged to operate from 50 to 3000 amps.

One of the 20,000 different Pope Spindles may be just the one you need. May we have your specifications?

No. 133A

POPE

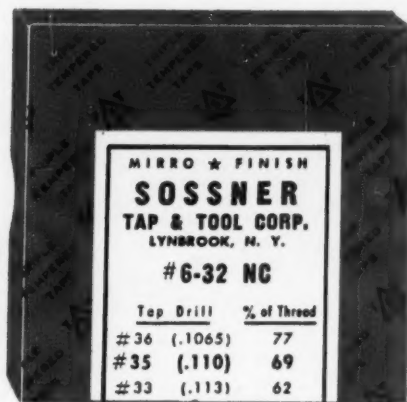
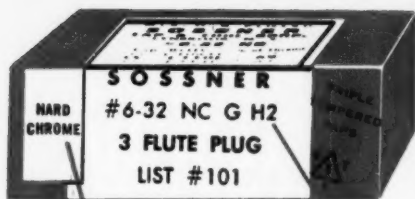
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awkward,
hard-to-handle
jobs easy ...**

Difficult straightening, pressing, clamping, forming, and testing operations are made simple with this versatile Dake hydraulic press. The entire pressing frame can be rolled out of the way to permit the placing of large, heavy, or bulky work on the pressing table. And the powerful, self-contained workhead is movable in every direction—left, right, up, down—to permit positioning over the point where pressing force is required.

Standard model, single acting, movable frame presses are available for air or electric operation in capacities from 25 tons to 150 tons—other models and designs in capacities from 200 tons to 300 tons. For detailed information, send for Catalog 424.

DAKE CORPORATION

612 Robbins Road Grand Haven, Michigan

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SOMEBODY

is doing it for

LESS

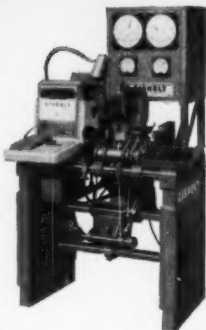


Gisholt MASTERLINE® 15

Balancer — Shown with separate unbalance location (angle) and amount meters for each correction plane. Readings hold until corrections are made. Offers complete plane separation — needs no special foundation — correction planes can be inside or outside work supports.

New HS line handles miniature, high-speed parts — impellers, armatures, gyros, self-driven assemblies.

Contact your Gisholt Representative, or write for Catalog 1109D.



How long since you analyzed your balancing methods in light of recent developments?

One year? Two years? Take a fresh look. If you still rely on operator skill or judgment, accuracy suffers, time is lost, reject rates or field failures are high.

With Gisholt balancers, guesswork is eliminated. You can locate, measure, correct and inspect in *one handling*.

Only Gisholt offers all the advantages you need to do it for less.



GISHOLT

MACHINE COMPANY

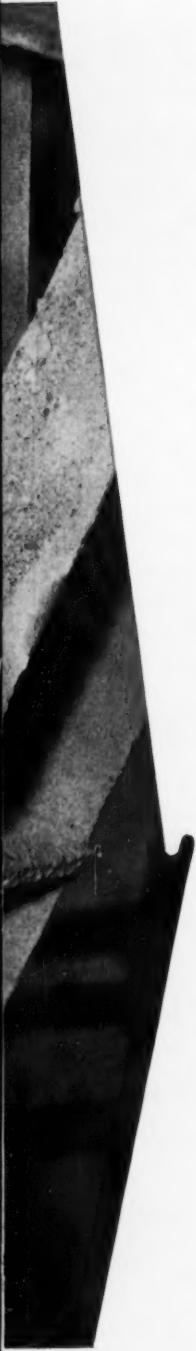
Madison 10, Wisconsin, U.S.A.

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Factory-Rebuilt Machines with New-Machine Guarantee

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The right seals on this bearing, and service life was increased 4 times!

This conveyor belt carries wet sand. The water and sand penetrated the felt seals of the bearings and caused frequent bearing failure. Our bearing engineers were consulted and their solution was a pillow block with neoprene plyaseals. Now after more than a year of operation, our customer reports service life of the bearings has increased four times.

This is just another example of the kind of service our bearing sales engineers give their customers. We try to get the right bearings in the right application and if the result is a saving on bearing purchases — that's fine with us. Our growth over the years proves that the more we save a customer, the more he buys. We'd like to help you save on bearing purchases — Call the branch nearest you!

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in the North →*

and

in the South →

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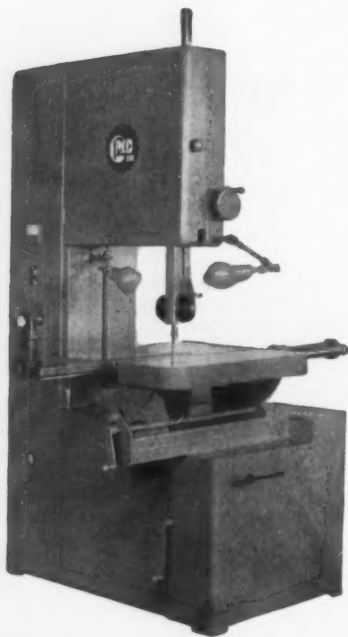
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GROB SPELLS THE DIFFERENCE IN BAND SAW MACHINES

' The new GROB 24" universal band saw
has all the famous GROB features:

Quality • Efficiency • Durability • Strength
Utility • Low Maintenance • Reasonable Cost



- Speeds infinite from 35-12000 FPM covers both cold and hot sawing

- Variable drive 3-speed transmission with precision rolled gears and splines transmits 15 HP

- Hydraulic table feed

See the difference demonstrated in our dealers' showrooms

or

Write GROB INC. for complete specifications

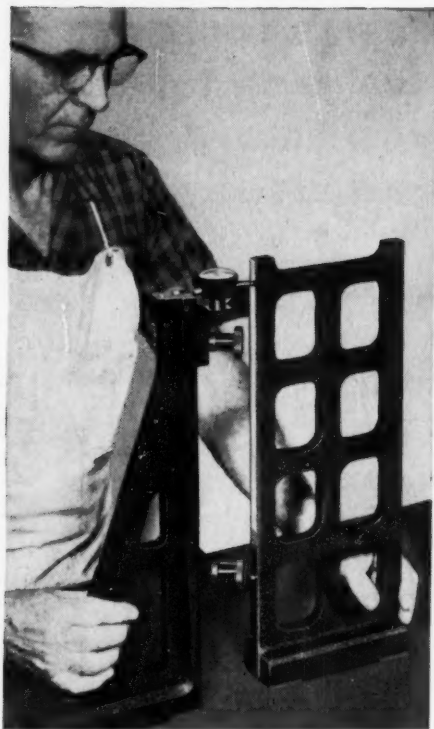
GROB also manufactures a complete line of:



**BUTT WELDERS
FILING MACHINES
GEAR ROLLING MACHINES**

GRAFTON, WISCONSIN

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FAST, True-Square Setups With The Robbins 90° Indicator Gage!

- Checks squareness instantly
- Registers angular errors to plus or minus .0001"
- Dial indicator for easy, visual measurement
- Designed for toolroom, inspection or production use
- Includes Master Square accurate to .0001"

With the Robbins 90° Indicator Gage, inspection and setups are faster, easier, more accurate. No special skills are needed to use it, no shimming or complicated build-ups are needed to check squareness.

A dial indicator visually reads 90° angles with accuracy to plus or minus .0001" on surfaces from 1½" to 17¾" long. The Robbins Indicator Gage also checks relative position of parts or fixture components, and, when used with Robbins

Magna-Sine or non-magnetic Sine Plates, it quickly checks accuracy of angles other than 90 degrees.

The Robbins 90° Indicator Gage is furnished complete with Dial Gage, Master Square accurate to .0001", and fitted hardwood box. Contact your Robbins Representative, or write direct for price and application data on this money-saving shortcut to true-square inspection and machining.

61-2R

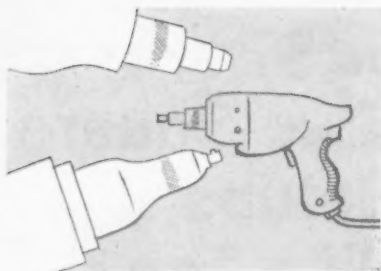
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PRECISION MACHINE TOOLS - GRINDING AND BURNING SPINDLES - CUTTING TOOLS - RAILROAD PINS AND BOLTS - DRILL AND REAMERS - JOG AND FIXTURE COMPONENTS - TORQUE ACTUATORS - CONTOUR PROJECTORS - GAUGES AND GAGING EQUIPMENT - GRANITE SURFACE PLATES - COMPUTER PRODUCTS - AIRCRAFT AND MISCELLANEOUS PRODUCTION PARTS - X-RAY ENERGY EQUIPMENT - DAIRY AND OTHER PACKAGING EQUIPMENT

EX-CELL-O CORPORATION

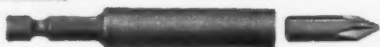
Greenville Plant, 945 E. Sater St., Greenville, Ohio

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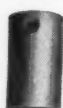


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and money...**

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There are over 7,000 types and sizes of Apex Nut Running and Screwdriving Tools, for use with all popular makes of air and electric power tools.

NUT RUNNING TOOLS - Catalog 30-A — $\frac{1}{4}$ " to $\frac{5}{8}$ " hex, square drives.

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NOW YOU CAN GET ROTATION WITHOUT VIBRATION

Here's What the Revolutionary New TECHNICA CENTER GRINDING MACHINE

can produce for you with UNSKILLED labor:

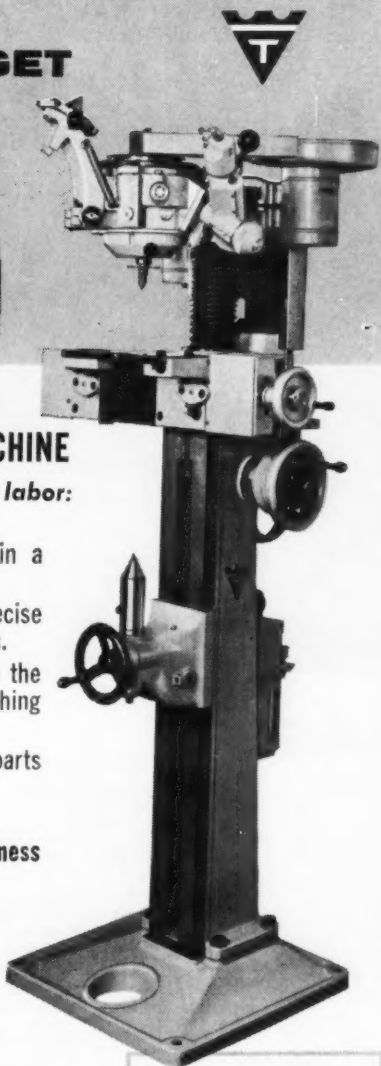
1. It generates a true geometric center in a standstill workpiece.
2. It positions two opposite centers in precise alignment establishing a geometric axis.
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4. It shifts centers to correct and salvage parts that are eccentric.
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6. It establishes concentricity and roundness within millionths of an inch.

**STOP LOSSES NOW. DIMINISH METAL
REMOVAL—MAKE MORE PROFITS.
GET THE FACTS ABOUT THE REVOLU-
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ITSELF QUICKLY!**

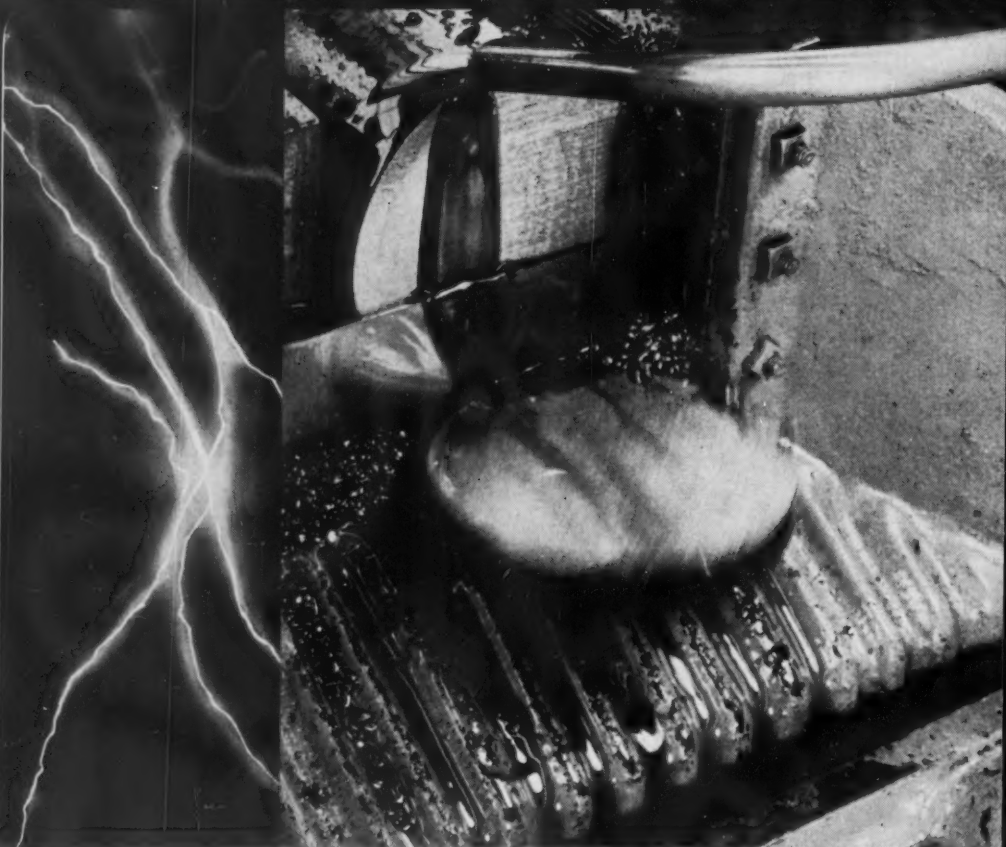
HIGH PRECISION PRODUCTS

WESTFIELD, NEW JERSEY

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Write for complete
information and our free
booklet — "A GUIDE
TO BETTER CENTERS".



FAST!

Your hack sawing machines will produce faster cutting-off on all types of work when they are equipped with unbreakable Marvel High-Speed-Edge Hack Saw Blades.

Why? Because these are the blades specifically designed to take the high speeds and heavier feed pressures demanded by today's production schedules.

What's more, your operators know—or will soon learn—they can increase speed and pressure without endangering themselves or the machine, because these are unbreakable Marvel High-Speed-Edge Blades . . . the blades that have set the standard for all other blades to match—if they can.

Ask for Marvel High-Speed-Edge Hack Saw Blades by name and you can be sure you're getting the unbreakable blades designed to give you maximum accuracy and speed in your cutting-off operations. Leading Industrial Distributors have Marvel Blades in stock.

Write for the latest Cutting Tool Bulletin
and the name of your nearest Marvel Distributor.

MARVEL *Metal Cutting* **SAWS**

**BETTER MACHINES
BETTER BLADES**

ARMSTRONG-BLUM MANUFACTURING CO. • 5700 Bloomingdale Avenue • Chicago 39, Illinois
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How to pick the right rust preventive

Rust and corrosion of metal parts during manufacture and in storage cost industry millions of dollars every year. Yet this need not be. A simple application of a rust preventive can save untold dollars.

One of the common fallacies that result in rusted or corroded metals is that "any oil" will do. In most cases it will—for a while. But "any oil" is not an effective protector of metal. The formulation of a quality grade of rust preventive is the result of intensive laboratory testing.

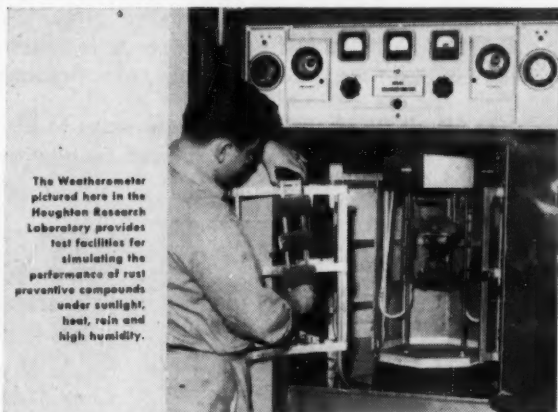
Often a rust preventive must do more than protect against moisture. Sometimes it must be "polar active"—have an affinity for metal that is strong enough to cause it to creep under water on a metal surface and actually raise the water off the surface.

Other Considerations

In certain applications resistance against oxidation is another required property. When oxidation occurs, corrosive materials are formed which attack the metal.

Another consideration is what is to be done with the part which has been protected. If it is to be plated or painted, an easily removed coating is necessary. If it is to be shipped overseas, the coating must withstand salt spray and wide variations in temperature and humidity. If the part or machine is to be exposed to weather—outdoor storage—it must resist the mechanical battering of wind and rain, and the effect of sunlight and variations in temperature.

These are some of the basic considerations involved in picking the right rust preventive for the job. Houghton has been compounding rust preventives since 1869. The familiar name "Cosmoline" was introduced by Houghton and is still used to designate government specification rust preventives. "Rust



The Weatherometer pictured here in the Houghton Research Laboratory provides test facilities for simulating the performance of rust preventive compounds under sunlight, heat, rain and high humidity.

Veto" is Houghton's name for its industrial protective coatings.

Below is a bare outline of facts required in order to determine the

right rust preventive for any metal, under any conditions of exposure, which will result in adequate protection at lowest cost.

Among the items which may be required to choose the right rust preventive are the following:

- Metal to be protected
- Type of surface finish
- Possible contamination of surfaces
- Previous cleaning procedure
- Storage conditions
- Type of film desired
- Fire hazard, if any
- Need for removability

The Houghton Man has a complete questionnaire form for determining the type of rust preventive best fitted for a particular need. Ask him for a copy to be used as a guide in requesting a recommendation. E. F. Houghton & Co., 303 W. Lehigh Ave., Philadelphia 33, Pa.

H **Houghton**
INDUSTRY'S PARTNER IN PRODUCTION

For more data circle 330 on Postpaid Card

Do you know what metallizing can do for you today?

With today's improved metallizing materials and methods:

PLANT EXECUTIVES find new ways to slash maintenance costs, reduce downtime, cut machine parts inventory...

JOB SHOP OPERATORS find new ways to build highly profitable business doing parts-salvage and maintenance work for plants in their area.

JOB SHOPS

make good money with metallizing because they save good money for local firms.

METCO has prepared a special bulletin detailing actual operations and costs of typical flame spraying work on shafts, templates, bearings, many other surfaces. Use coupon to get your free copy.

NEW! Business-building kit

for job shops, to help METCO equipment owners build new business, pay off investment in minimum time, and use flame spraying to increase other machining and welding business. Contains samples of direct mail letters, post cards, envelope stuffers, photos, advertising mats. These promotion materials are available in lots of 100 at our cost, well below what you'd have to pay to print your own. One copy of kit available free—send for it today. (See coupon.)

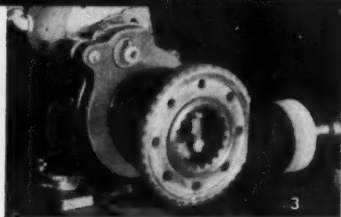
These real-life examples show how plants save money, job shops make money with metallizing

Necks of winding rolls in a textile mill were formerly repaired by a slow machining method, requiring highly skilled labor. Now the worn necks are built up with flame sprayed metal, quickly machined to size. Savings run \$20,000 a year.

A **job shop** in California specializes in flame spraying oil well pump plungers, gets all the business it can handle in spite of the fact that the plungers it hard-faces last eight times as long as new ones. The largest ones cost only \$45.00 to rebuild, against \$110 to replace. Volume on just this one profitable metallizing service: \$35,000 a year.

Valve plugs and seats, working in sand, oil and salt water, lasted only a few hours in service. Hard-faced by welding, a set cost \$155, lasted from 3 to 8 hours. When flame sprayed with tungsten carbide powder, service life was increased to a minimum of 2 weeks, 4100% longer! Cost of metallized set, \$73. But reduced downtime far outweighs the dollar savings.

A **Connecticut job shop** makes a very good profit when it flame sprays small



Any good mechanic can quickly master the three basic steps of metallizing: 1. prepare the surface; 2. flame spray; 3. finish.

shafts for \$27.50. The customer is happy, too—he formerly had to pay over \$50 to have shafts built up with welding.

The same job shop salvaged a big degreasing tank, value \$2,850, by flame spraying with zinc for \$683. The shop made money, the customer saved money.

A shipbuilding company installed metallizing equipment to repair such parts as pump rods, pistons, crank shafts for diesel engines, stern bushings, valve stems. A badly worn tugboat shaft, replacement cost \$3,000, was repaired and made better than new for \$400. That job alone more than paid for the METCO equipment.

From these cases you can see how modern metallizing pays, whether in plant maintenance departments or in job shops serving the many companies that

don't need their own installation. Wherever there's wear, in rotary or sliding action, there's an opportunity to save money and make money.

New and improved materials

Among these new materials are a number of nickel, chrome, boron hard facing powders. Sprayed tungsten carbides are also widely used. Many others are available to give new values to the basic benefits of metallizing, which may be summarized as: less downtime; far less machining or grinding time, reduced parts inventory; and "better than new" performance of the metallized parts.

With savings like these there is plenty of leeway for good job shop profits and big savings for manufacturing plants. To learn more about these opportunities, check the coupon and send it off today.

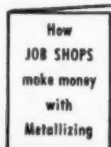


METCO INC.
FORMERLY METALLIZING ENGINEERING CO., INC.
Flame Spray Equipment and Supplies

1177 Prospect Avenue, Westbury, L. I.
New York Telephone: Edgewood 4-1300
Cable: METCO. In Great Britain: METCO,
Ltd., Chobham-near-Woking, England

METCO, INC., 1177 Prospect Avenue, Westbury, L. I., New York

JOB SHOPS ONLY



- ☐ Send Bulletin 14, "How Job Shops Make Money With Metallizing"
- ☐ Send Business-Building Kit
- ☐ Have Field Engineer Call

PLANT MANAGEMENT



- ☐ Send copy of Bulletin 15, "How to Save Money and Cut Downtime with Metallizing"
- ☐ Have Field Engineer Call

Name _____

Title _____

Company _____

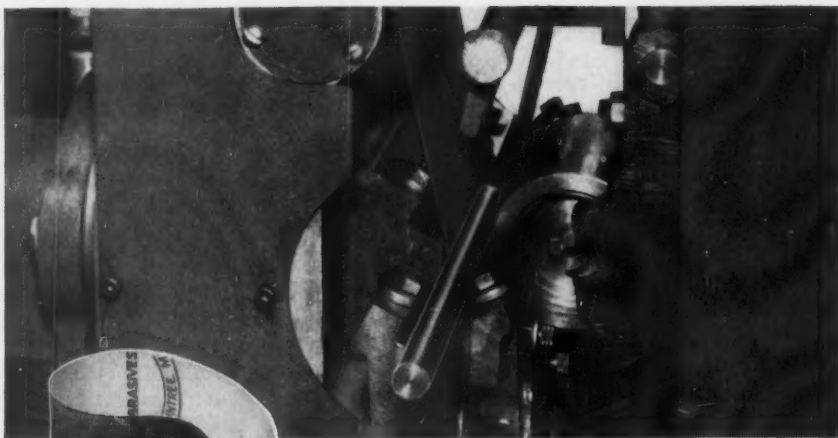
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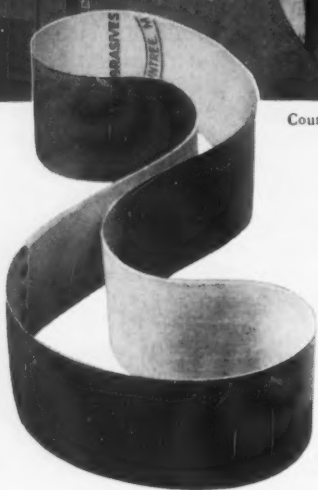
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for a superior finish when centerless grinding, specify Jewel Brand abrasive belts



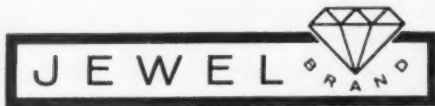
Courtesy of Production Machine Company, Greenfield, Massachusetts



The 486 Centerless Grinder is designed for precision grinding and finishing small parts by plunge cut or thru-feed methods. It is equipped with a ground steel contact roll or a rubber faced contact roll for low micro-inch finishing.

No matter what the grinding method or the operation to be performed, there's a Jewel Brand abrasive belt designed for it. That's why experienced operators specify Jewel Brand. They know they'll get the right bond, the right backing and the right grain. Next time, why don't you specify Jewel Brand?

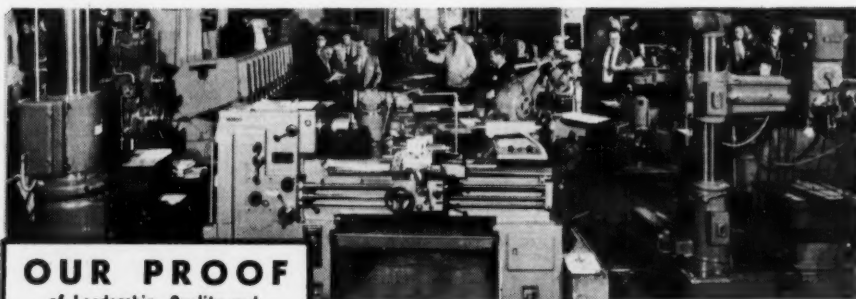
For a trial run, call your industrial distributor or write: Abrasive Products, Inc., South Braintree 85, Mass.



COATED ABRASIVES

belts • rolls • sheets • discs • specialties

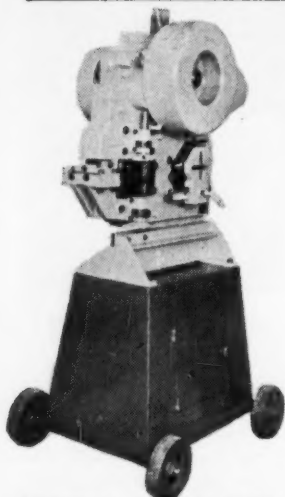
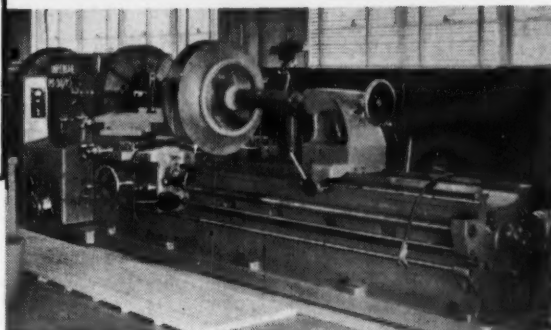
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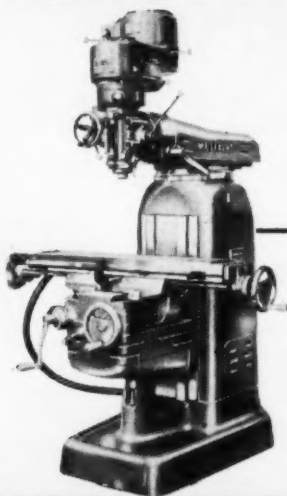
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Acceptance.

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IMPERIAL MULTI-MATIC #10 IRONWORKER

Stationary and portable types
SHEARS — PUNCH — COPING
— NOTCH and BAR CUTTER.
\$2895.



IMPERIAL SLIDING BED GAP LATHE

from 30' ctrs. to 300' ctrs.
MISSILE — T — SLIDING BED
& SPECIAL LATHES TO ORDER.
Flame hardened, ground bed ways.
Heat-hardened gears throughout.
Precision roller spindle bearings.

IMPERIAL-WESTBURY

Model IS TURRET MILL

Complete \$2034.50

Model T-1 TURRET MILL

Compound "Knuckle Joint," 12"
cross travel, 1½ H.P. 42" x 9"
table. Power feed to table measur-
ing and slotting attachments, ac-
cessories.

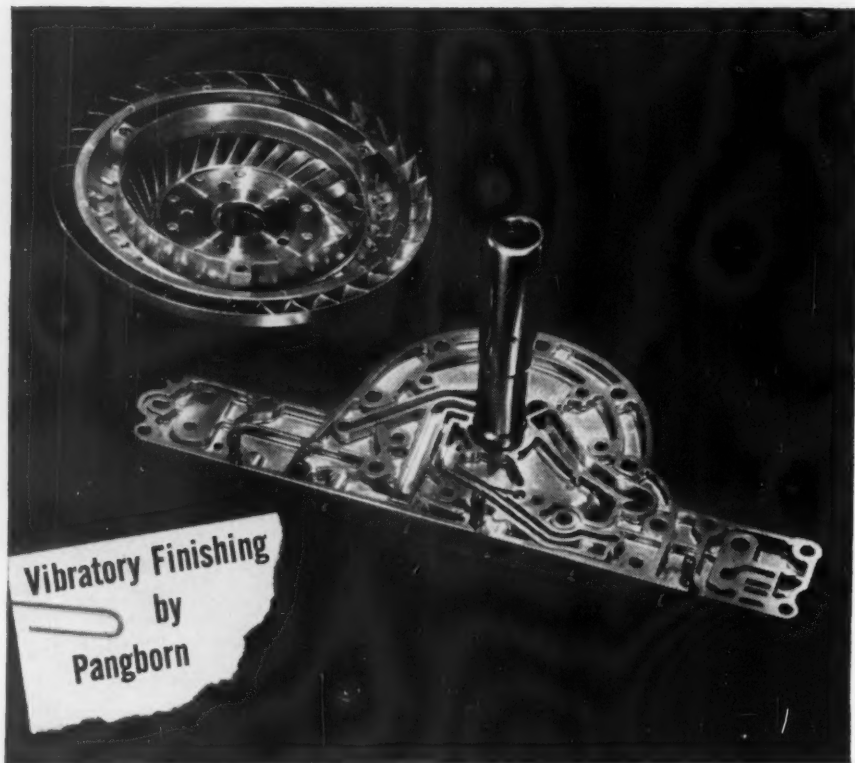
Complete \$2314.50

AARON MACHINERY CO., Inc.

45 CROSBY ST., N. Y. 12 • WA 5-8300

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Suddenly complex finishing has a simple solution!

The Pangborn Vibratory Finishing Machine has an unusually wide range of application. What would you like to descale, deburr, radius, finish or burnish?

Metal and metal alloy as well as many plastic and ceramic parts may be vibratory finished. This machine processes extremely small and delicate items with the same facility it handles large and heavy objects.

What's more, the Pangborn Vibratory Finishing Machine performs as much as 100 times faster than conventional equipment. Cuts costs? You bet!

All sizes of the machine come equipped with variable speeds and amplitudes plus new improved air-cushioned suspension. Option-

al air-cushioned floor mounts completely eliminate any transmission of vibration to the floor. Auxiliary equipment and the best in media and compounds are available for your every need. Send parts with exact finish specifications or finished specimen for sample processing in our laboratory to Mr. William E. Brandt at:

PANGBORN CORPORATION, 5600 Pangborn Blvd., Hagerstown, Md.; Pangborn Canada Ltd., 47 Shaft Rd., Toronto (Rexdale), Canada—Manufacturers of Vibratory Finishing, Blast Cleaning, Dust Control Equipment — Rotoblast® Steel Shot and Grit®.

Pangborn
OF HAGERSTOWN

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FRINK SNO- PLOW Corp.

of Clayton, N.Y., leading manufacturer of heavy snow plow equipment, uses MILBAND for production cut-off work on variety of steel parts.

MILBAND® Band Saw Machine Tool

**One MILBAND Machine Replaced two other
cutting machines at Frink Sno-Plow Plant**

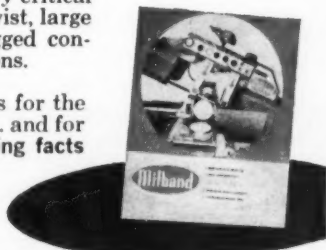
In 1959, a MILBAND Machine was installed to do the work of two other cutting machines. When the MILBAND was destroyed in a disastrous fire in September, 1960, Frink Sno-Plow insisted that another MILBAND Machine be rushed to the plant.

"It was a question of rebuilding production schedules fast to survive," said Shop Foreman Richard S. McAllister. Advantages of the automatic MILBAND Machine Tool noted by Mr. McAllister were, "cost per cut down appreciably . . . increased production . . . ease of operation." An important feature of the MILBAND that makes it especially applicable to the Frink operation is its ability to handle a wide variety of tough cut-off jobs. Users also find that the *MILFORD REZISTOR High Speed Steel Blade* in combination with the MILBAND is ideal for maximum blade life and cutting accuracy. The reason is superior Blade Control Engineering at every critical point of the MILBAND . . . only 30° blade twist, large 22" blade wheels and 15½" pivot span, rugged construction . . . to eliminate destructive vibrations.

Demonstrations are easily arranged. Write us for the name of the MILBAND dealer nearest you . . . and for this free circular explaining all the **cost-cutting facts** about the MILBAND Machine Tool.

THE HENRY G. THOMPSON & SON CO.
Chapel & Will Streets, New Haven 5, Connecticut
Saw Specialists for 85 Years

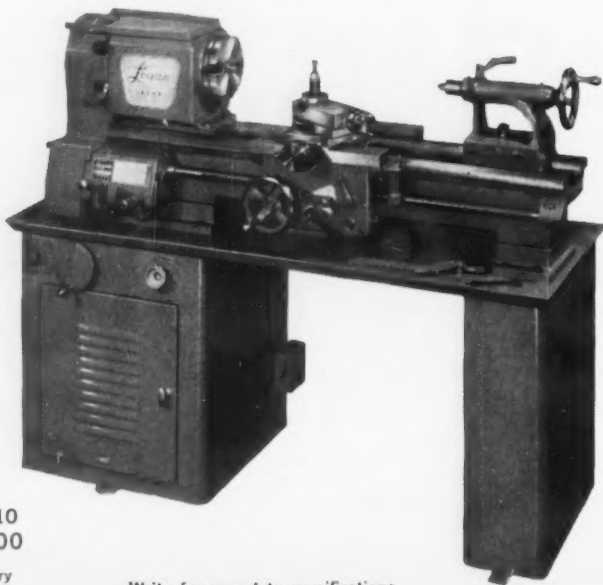
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dependable

Logan / 14"
LATHES

How is a lathe's dependability measured? One criterion is the lathe's productive life-span. And this life-span is largely determined by the lathe's quality of design and construction. The Logan lathe bed is an example. It withstands the heaviest bending and torsional stresses. A special alloy and thorough seasoning (before and between machining) insure a warp-free bed. You can depend on Logan's low operating cost, too. The 14" swing lathes have variable speed drive (40 to 1400 RPM), and are instantly adjustable while work is turning—without shifting belts! You can also depend on the flexibility of Logan lathes. They have a 9" swing over saddle, 14 $\frac{5}{8}$ " swing over bed, and a 1 $\frac{1}{16}$ " collet capacity to permit a wide variety of operations. But, specifications tell the full story. So, write today for complete information.



Model 6510
\$1,775.00

F.O.B. Factory

Write for complete specifications.

Logan

LOGAN ENGINEERING CO., DEPT. L-661
4901 W. Lawrence Ave., Chicago 30, Ill.

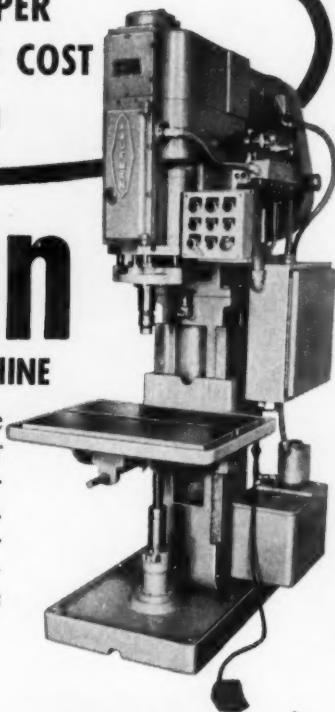
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on any tapping job . . .
**MORE PRODUCTION PER
HOUR means LOWER COST**
for YOU with a

kaufman

MODEL 10E-20 TAPPING MACHINE

More and more manufacturers are learning this fact from hour after hour, day after day, precision production tapping on the Kaufman 10E-20. With higher production, lower product cost, increased sales in mind — you, too, should learn all about the Kaufman 10E-20.



Get the complete facts today!



Write, wire or phone for complete information on the precision tapping machine — the Kaufman 10E-20.

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MFG.
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**PRECISION MACHINES
FOR TOP PRODUCTION**

551 S. 29th St., Manitowoc, Wisconsin

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Put your foot down on SHEARING COSTS



Lodge & Shipley 24" SPEED SHEAR

The Lodge & Shipley 24" Speed Shear is so quick you'll be saving money from the first stroke it makes in your plant. From installation . . . through set-up and maintenance . . . to actual shearing speed of 120 strokes per minute, it really lives up to its name!

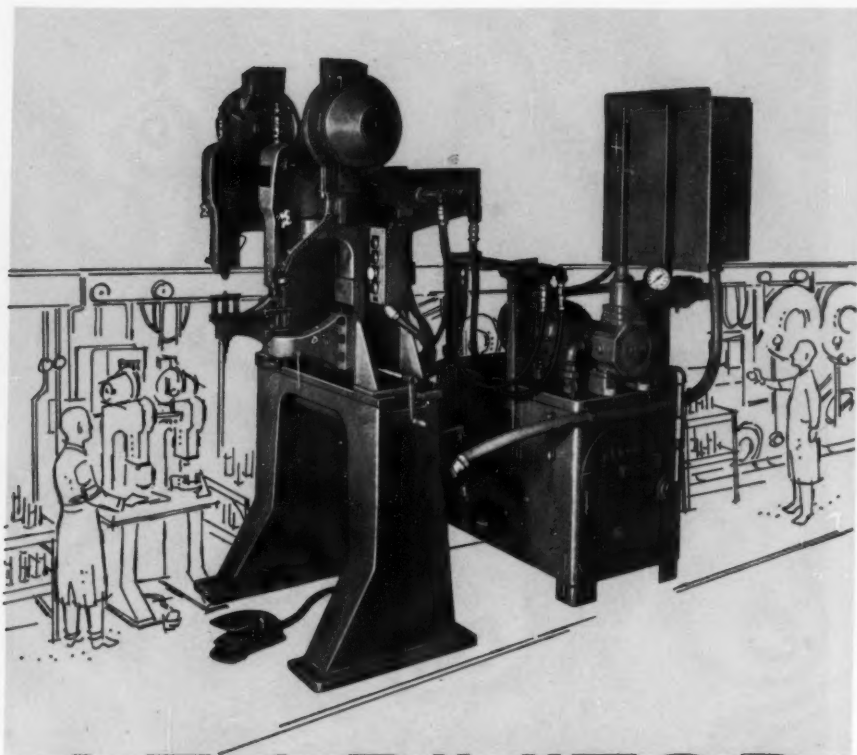
Uniquely designed for straight shearing (with back gauge), angle shearing, sequential shearing, slitting, notching, blanking and duplicating straight-side parts without dies, the Speed Shear offers unequalled speed, versatility and convenience.

Whether it's your only shear or used to release a big, slow shear from small shearing jobs, the Speed Shear can cut shearing costs in your plant. Want more facts? Write: The Lodge & Shipley Co., 3058 Colerain Ave., Cincinnati 25, Ohio.

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**IN SHEARS, TOO . . .
YOUR LODGE-ICAL CHOICE**

Lodge & Shipley



A T-J RIVITOR

on your production line
means higher production rate . . . lower unit cost!

T-J Rivitors and Clinchers are designed, engineered and manufactured to conform and operate efficiently on today's high-speed production lines. For whatever your product . . . if it demands a fastening assembly procedure . . . a T-J riveting or clinching machine adds to its high quality standards by their ability

in providing long, rugged service-free life.

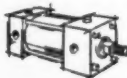
Many standard designs to choose from . . . or a T-J can be custom designed for your exact requirements. Write Tomkins-Johnson, 2425 W. Michigan Ave., Jackson, Mich., today. Ask for Rivitor and Clinchor Bulletin No. 646 or Clinchor Bulletin No. 555.



RIVITORS



CLINCHORS



CYLINDERS



CUTTING TOOLS



TOMKINS-JOHNSON

JACKSON, MICHIGAN

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PRECISION:

Reason enough

Deryllium specialists, Leemath Incorporated of Long Island, create delicate and precise mechanisms in this high strength but toxic and abrasive wonder metal. In their temperature-controlled shop, this feather-light gyro float assembly (shown actual size, right) was turned on a special high-precision LeBlond Dual-Drive Lathe. *Spherocity had to be concentric with the two major axes within .0005" total indicated runout of 1.8750"!* (In order to hold the assembly that close, component tolerances had to be even tighter!)

To perform such touchy work, Leemath ordered their LeBlond 15" Dual-Drive to ultra-high precision standards. For this lathe Timken furnished specially-made bearings with one-

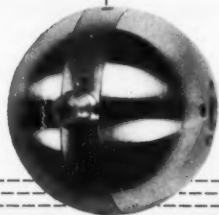
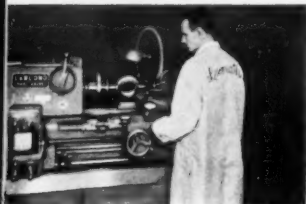
third the runout of their finest precision class. With it came the standard features that give LeBlond its reputation for long-lived precision—combination gear-belt drive headstock with 16 speeds, 31 to 2400 rpm; compensating vee bed way construction with hardened steel shears; thrust-lock tailstock; and many more.

People buy lathes for many reasons. But when, like Leemath, they must have precision they can depend upon, that is reason enough to buy LeBlond.

If you would like to have the full story of LeBlond's Dual-Drive, ask your distributor or write for Bulletin 6C.



to buy LeBlond



---THE R. K. LeBLOND MACHINE TOOL COMPANY---
Cincinnati 8, Ohio---

June, 1961

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MODERN MACHINE SHOP 35

NEW GORTON RAIL-TYPE MILL



Designed for numerical control!

To satisfy the exacting requirements of numerical control, Gorton announces the all-new Double-Column Rail-Type Milling Machine. Designed for positioning and continuous path contouring system applications.

Features

- Precision ball bearing screws with preloaded nuts
- Positive anti-backlash drive system
- Bed-type design
- Electric or hydraulic motor control of axis movement
- All way surfaces guarded
- Unique air-balanced vertical slide
- Various types of heads available
- Spindle speed selection — manual or programmed
- Automatic lubrication

Specifications

Table	-	-	-	-	22" x 32"
Table Travel	-	-	-	-	(X Axis) 24"
Rail Slide Travel	-	-	-	-	(Y Axis) 32"
Vertical Slide Travel	-	-	-	-	(Z Axis) 10"
Quill Travel	-	-	-	-	(Manual) 4"
Spindle Speeds	-	-	-	-	80-10,000 R.P.M.
Clearance between Columns	-	-	-	-	36"

See this machine in operation at the Thompson Ramo Wooldridge Booth, ASTME Show

A Gorton Product, the Finest of Its Kind!

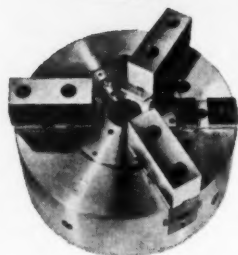
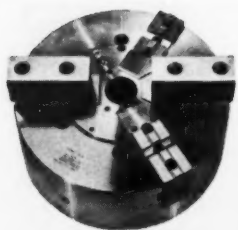


GEORGE GORTON MACHINE CO.

1706 RACINE STREET, RACINE, WISCONSIN

Milling, Die Sinking, Drilling and Engraving Machines with Manual Hydraulic, Electro-Hydraulic or Numerical Guidance Systems.
 SINCE 1893. Special Machines and Automated Transfer or Indexing Machines. Cutting Tools and accessories... Defense and special products.

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One Dual Purpose Power Chuck saves set-up time, cuts costs

The Skinner Dual Purpose Power Chuck is designed with four master jaws so that it may be used as a two- or three-jaw chuck. It is no longer necessary to pay for one chuck to machine round work, and an additional chuck to machine odd shapes and castings. Not only do you save the cost of an additional chuck, but you also save set-up time by changing jaws as necessary.

Dual purpose power chucks are available with adjustable, non-adjustable, or serrated jaws, in sizes 8" to 36". Like all heavy-duty Skinner power chucks, they are:

- SIMPLE**—Fewer moving parts
- ACCURATE**—Repeat within .001" on diameter
- STRONG**—Forged steel bodies
- DURABLE**—Carefully hardened wearing surfaces

Skinner power chucks are available for direct mounting on American Standard Spindles and for mounting on threaded spindle noses by means of separate adaptor plates.

FOR MORE INFORMATION about power chucks and other major chuck developments, contact your Skinner Representative or write us at Department 176.

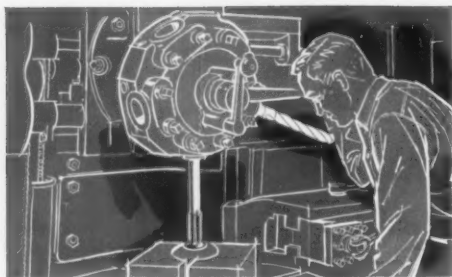


THE CREST OF QUALITY

SKINNERCHUCKS

SKINNER-HORTON CHUCK DIVISION
SKINNER PRECISION INDUSTRIES, INC. • NEW BRITAIN, CONNECTICUT, U.S.A.
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How
to
get
cost reduction
through
"Teamwork Tooling"



As a result of cooperation of his Industrial Supply Distributor and a CLEVELAND Service Representative, this customer was able to ream 1,800 holes per grind in a 1040 steel projectile part, without sacrifice of hole size or finish. A typical example of "Teamwork Tooling"!



When you tackle the problem of cost reduction, you will find the solution is not *cost per tool*, but rather *cost per hole*.

And, if you apply Value Analysis to the subject of cost per hole, you always arrive at the same answer: Only with *quality* tools can you get faster production, less down-time and fewer rejects.

When you buy CLEVELAND Tools you get the very best manufacturing experience and know-how . . . *plus* the added benefits of "Teamwork Tooling", which means combining the skills of many people to help you reduce costs.

CLEVELAND Quality Tools can be obtained from the stocks of your local Industrial Supply Distributor, who has the assistance of our trained Service Representatives to recommend savings through proper tooling for *your* job conditions.



THE CLEVELAND TWIST DRILL CO.
Cleveland 1, Ohio

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QUALITY



CUTTING TOOLS

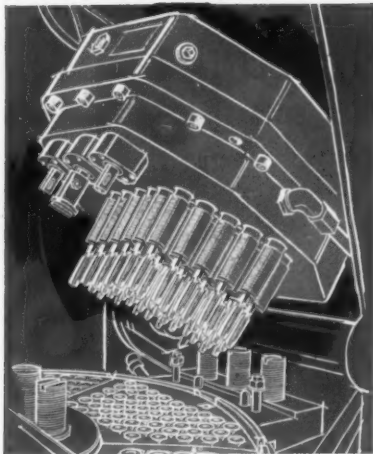
• BEST SERVICE



THROUGH YOUR LOCAL DISTRIBUTOR

For more data circle 342 on Postpaid Card

To Help You Cut Your Tapping Costs



BAY STATE Taps have the strength and stamina to reduce costly down-time on this high speed set-up, where 25,000 holes are threaded per hour. The taps have built-in **QUALITY** . . . your assurance of cost reduction on all jobs, whether large or small.

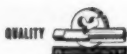
The most economical tapping operations can be performed only with *highest quality* taps.

You can reduce your costs with BAY STATE *Quality* Taps. These tools are designed, engineered and manufactured for precision performance . . . to give you long, dependable service which is your assurance of maximum production with a minimum of costly down-time.

BAY STATE *Quality* Taps and Dies are carried in stock for prompt delivery by your local Industrial Supply Distributor, who maintains balanced inventories for you at lowest cost. Moreover, the steady flow of orders from hundreds of distributors enables us to produce the tools in large, economical quantities—with resultant advantages to you.

BAY STATE TAP AND DIE CO.
Mansfield, Mass.

Subsidiary of The Cleveland Twist Drill Co.



CUTTING TOOLS

BEST SERVICE

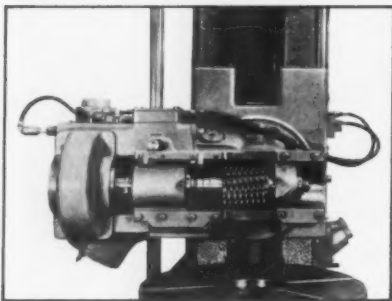


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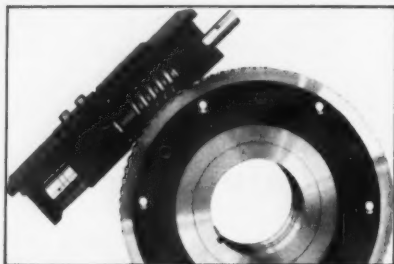
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For more data circle 343 on Postpaid Card

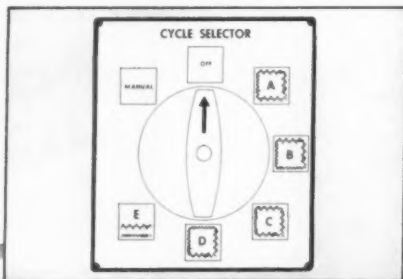
On **G & E** Gear Hobbers you can get features like these...



Automatic hob shift apportions wear over entire hob length, throughout roughing and finishing operations. Hob spindle bearings rigidly clamped during cut.



DUALEAD worm gearing assures accurate indexing under heaviest production, at high operating speeds. Worm thread design simplifies adjustment, improves backlash control, assures uniform motion in both directions of rotation.*



Automatic Quadcycle with rough and finish cycle option makes gear cutting completely automatic. Operator needs only to load work and push RUN button. Specific cycles in an operation are selected by a single setting-dial.

plus advantages like these...

- Hydraulic counter balance of hob slide — variable to meet cutting conditions — eliminates backlash and chatter, permits high hobbing speeds, lengthens hob life.
- Tracer-controlled crown hobbing accurately

produces a total amount of crown within a few "tenths", per inch of face. Simple inexpensive template locates high point and amount of crown anywhere on gear face. Also applicable to highly crowned couplings.

*Standard equipment

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — BERNHARDT DIVISION: Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

with everything under control!



Dial control of infinitely variable adjustments of hob speed — for optimum cutting action at new high speeds.

Finger-tip control of hob reversal without idler gears — no time lost in reversing.*

Outstanding accuracy has long established G&E Universal Gear Hobbers as the most dependable machines for practically every gear cutting application.

Precision performance is built into every G&E Hobber... with many advanced optional features like the ones described here... and with a simplified, control system that increases automatic, cost-cutting benefits in sustained high production.

G&E Hobbers are made in ten sizes to produce gears from one inch to fifteen feet in diameter, with most features available on all.

For expert aid in selecting gear hobbers and other G&E machines, see your G&E distributor — or write to Norton Company, G&E Division, Worcester 6, Massachusetts.



MACHINE TOOLS

Making better products

...to make your products better

MACHINE TOOL DIVISION: Grinding and Lapping Machines — G & E DIVISION: Shapers • Gear Cutting Machines

For more data circle 344 on Postpaid Card

June, 1961

MODERN MACHINE SHOP

41

Like Other True Thoroughbreds...

Just as the blood lines in a superior race horse are recorded for posterity — so the Pipe Machinery Company keeps a complete and permanent register of "specs" on all their Solid Titanium Carbide Thread Ring Gages.

Manufactured to an amazingly high degree of accuracy, these sturdy Pipe Machinery thoroughbreds require their own special mating HILO type wear check plugs. They, too, are numbered and registered for your convenience.

Find out today how Pipe Machinery Titanium Carbide Thread Ring Gages can reduce your scrappage, speed up your inspection, insure the "assemble-ability" of your product. Write for further details on your company letterhead.

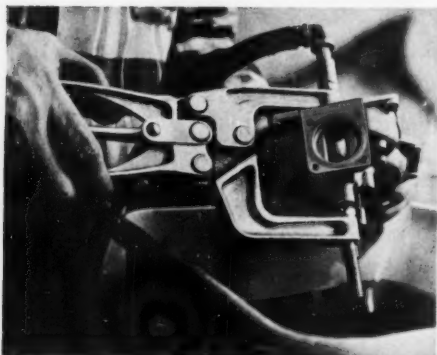


H. Alken del.

THE PIPE MACHINERY COMPANY 29100 Lakeland Boulevard • Wickliffe, Ohio • Greater Cleveland

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Look what clamps are doing!

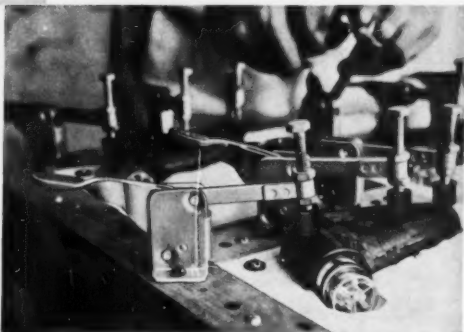


*Practical uses of Wespo
Toggle Clamps and Pliers that
may suggest ways you can save*

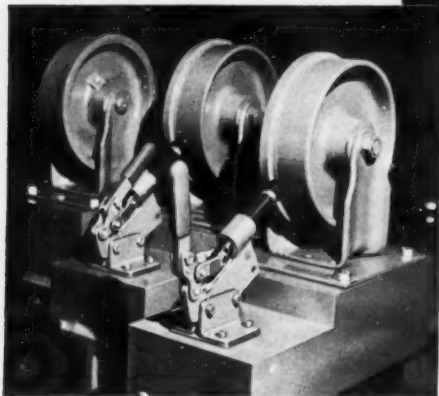
Toggle plier serves as low cost fixture for testing castings

The air line is connected through one jaw of a Wespo Model 522 Toggle Plier. The plier is then clamped onto the casting and air applied by a foot control. Immersing the casting into a tank quickly spots any defects. Patented "Quick trigger" feature of the Model 522 instantly releases the casting; speeds testing. Rugged, lightweight Wespo toggle pliers are available in various jaw capacities and sizes.

Holding these glued parts together while drying is a simple task with Wespo Horizontal Bar-Type Toggle Clamps. Neoprene-capped spindles prevent damage to plastic surfaces, yet securely hold the parts during the drying operations. Wespo toggle clamps are available in more than 80 types and sizes. So, the next time you think clamps, think Wespo!



Simple, low cost "parking brake" for this track-operated frame is provided by a Wespo Push-Pull Clamp equipped with a neoprene-capped spindle. "Brake" is quickly applied or released by a simple flick of the wrist. Wespo Push-Pull Clamps are available in various sizes and holding pressures and are ordinarily used on holding fixtures where push or pull clamping is required.



FREE CLAMP CATALOG!

Ask your Wespo distributor for your free copy of this 16-page Wespo catalog. It will help you quickly select the right clamp for every clamping job.



WESPO

DIVISION OF VLIER ENGINEERING CORPORATION
26935 W. Seven Mile Rd., Detroit 19, Michigan
Formerly West Point Manufacturing Company

For more data circle 346 on Postpaid Card



MARK FREIGHT CAR WHEELS OR PEN POINTS

ECONOMICALLY, AUTOMATICALLY WITH GTS MARKING EQUIPMENT

Whether you need an automated 250 ton unit for marking hot, pressure cast railroad car wheels or a machine for marking parts as delicate as a fine pen point, SCHMIDT has the experience and facilities to provide the right equipment for the job.

The in-line production marking machine above accepts hot (1200° F.) car wheels, positions and marks with consecutive serial number and other data in deep permanent characters—and discharges wheel to conveyor for next operation. Send today for Catalog No. 18.



SCHMIDT

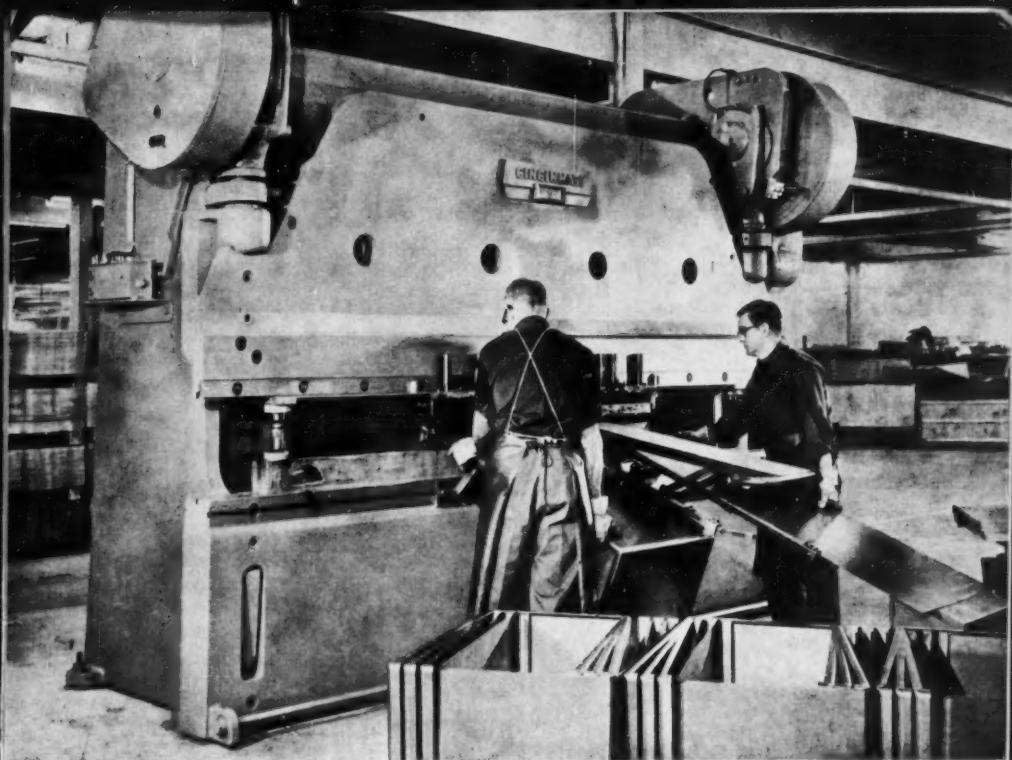
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Efficiency jumps 50%

CINCINNATI® PRESS BRAKE FORMS PROFITS FOR STEELCASE

50% more efficient than previous method, this 225/150-ton Cincinnati forms four radius corners on pedestal bodies. "High degree of accuracy and convenient operation," according to Steelcase, help operators produce 80 pieces per hour. The machine operates more quietly and takes less floor space than their previous equipment.

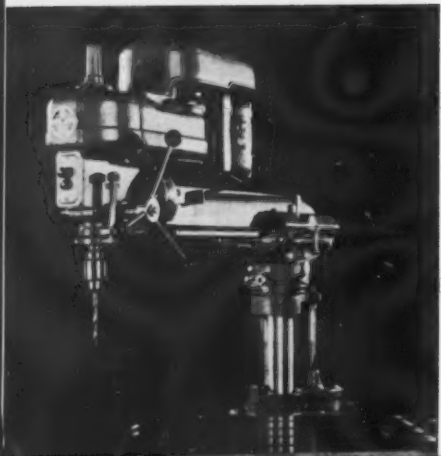
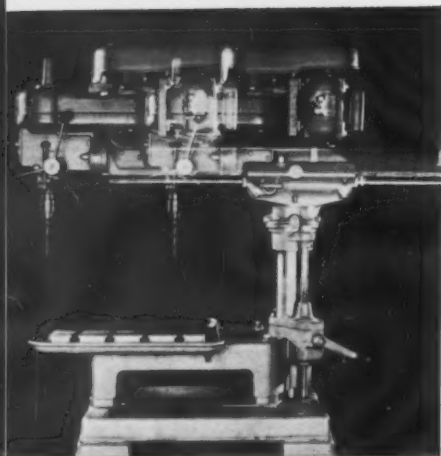
THE CINCINNATI SHAPER co.

Shapers / Shears / Press Brakes Cincinnati 11, Ohio, U. S. A.



In Scotland: The Cincinnati Shaper Co., Ltd., Glasgow
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ADVERTISING



Any way you look at it

YOU CAN'T BUY MORE FLEXIBILITY

At a low price of \$760.00* Walker-Turner "Light-Heavyweight" Radial Drill Presses do the work of machines costing more than twice as much! For fast set-up in drilling of large or heavy stock and to solve special horizontal or vertical drilling problems, they offer these important extras: *Extra wide drilling range*—head moves 18" on traveling ram, swivels 360° around column, tilts 45° left or right. *Extra speed versatility*—choice of 15 speeds from as low as 110 rpm to as high as 8300 rpm. *Extra capacity*—drills to center of 62" circle, your choice of 4 1/4" or 6" spindle travel. But the biggest extra is the extra savings you'll enjoy on fixturing and set-up time when you put this rugged machine to work on your toughest drilling jobs.

Visit your Walker-Turner Distributor (listed in the Yellow Pages under MACHINE TOOLS or TOOLS). Learn for yourself why more people in metalworking call Walker-Turner the *value line*.

**Model 1612-12*



Get information on all 24 models of the W-T Radial Drill Press. Write for FREE Catalog: Rockwell Manufacturing Company, Walker-Turner Division, Dept. WF22, 400 North Lexington Ave., Pittsburgh 8, Pa.

WALKER-TURNER
"LIGHT-HEAVYWEIGHT" MACHINE TOOLS

another fine product by

ROCKWELL



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TRUE



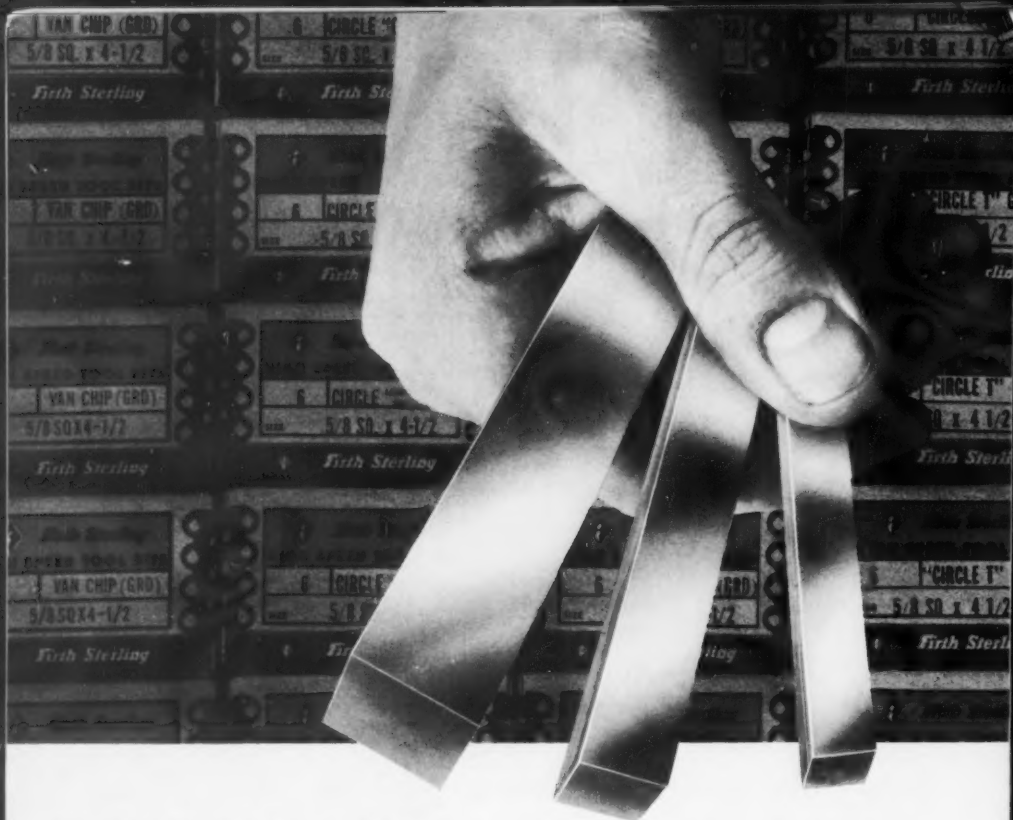
You may not get a "bargain price" on Barber-Colman cutters. But you always get a good buy. True cutter cost must include sharpening, scrap, tool-change downtime, and inventory. These can add up to eight times the cost of tool replacement. Just a little more tool life, toughness, or uniformity can prevent major additions to cost. Thrift, then, is really a question of quality. So buy the best—from your Barber-Colman distributor.

COST



BARBER-COLMAN COMPANY 64 Loomis Street, Rockford, Ill.

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PICK YOUR BITS for performance and service

CIRCLE C (T-5) (ground)

High Temperature Cutting

high cobalt-tungsten super high speed steel of well-balanced composition with superior red hardness and wear resistance.

VAN CHIP (M-3) (unground, ground)

General Purpose Cutting

high carbon, high vanadium moly-tungsten high speed steel with exceptional wear resistance and red hardness.

CIRCLE T-15 (T-15) (ground)

High Abrasive Cutting

tungsten base, high carbon, high vanadium cobalt high speed steel with superior abrasive resistance and red hardness.

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YOUR FIRTH STERLING DISTRIBUTOR carries a complete range of standard sizes in clearly marked, durable packages. Call him today for quality products and dependable delivery.



Firth Sterling

— INC —

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Offices and warehouses in principal cities



Drilling? Boring? Seize Your Numerical Control Advantage



Buy no new jigs and fixtures. Convert storeroom space for useful work. Cut down heavy inventory investment. Tape control is taking over.

More than 500 hours and \$5,300 went into making that obsolete drill jig in the foreground. It was used one year. You could make a tape to do the same work for \$50, store it in an envelope, revise it for model changes in 20 minutes.

For low volume drilling, milling, turning, and a host of other metal-working operations, there just isn't any other way to beat the cost-cutting ability of numerical control.

Before making new drilling and boring fixtures, write for the bulletin "FPB" describing Fosdick's numerically controlled precision boring and jig grinding machines. Write for bulletin "FTD" describing the 32-spindle Fosmatic Turret Drill. It's time to "get a proposal from FOSDICK!"



Write for
bulletin "FPB"

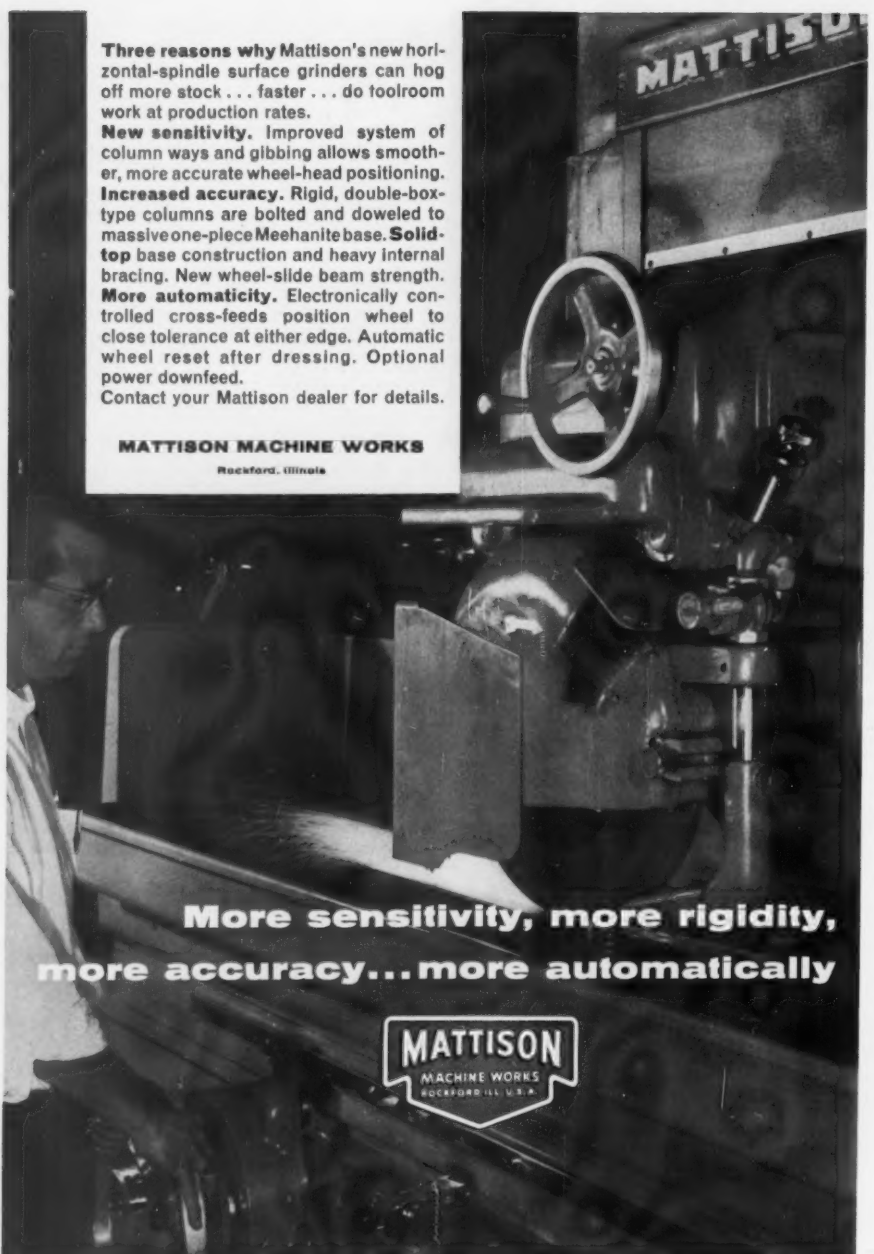


Write for
bulletin "FTD"

FOSDICK

The Fosdick Machine Tool Company
Cincinnati 23, Ohio

For more data circle 352 on Postpaid Card



Three reasons why Mattison's new horizontal-spindle surface grinders can hog off more stock . . . faster . . . do toolroom work at production rates.

New sensitivity. Improved system of column ways and gibbing allows smoother, more accurate wheel-head positioning.

Increased accuracy. Rigid, double-box-type columns are bolted and doweled to massive one-piece Meehanite base. **Solid-top** base construction and heavy internal bracing. New wheel-slide beam strength.

More automaticity. Electronically controlled cross-feeds position wheel to close tolerance at either edge. Automatic wheel reset after dressing. Optional power downfeed.

Contact your Mattison dealer for details.

MATTISON MACHINE WORKS

Rockford, Illinois

**More sensitivity, more rigidity,
more accuracy...more automatically**



For more data circle 353 on Postpaid Card

The Payoff is Performance



G-E Man-Made diamond bats 1,000 against high costs



Do you want to *do* something about high costs ... boost your grinding efficiency ... step up output per wheel?

Grinding wheels with G-E Man-Made diamond are making important contributions to the metalworking industry. An on-the-job test would show you that the crystal characteristics of controlled shape and friability that are built into G-E Man-Made diamond result in consistently superior grinding performance—bat 1,000 every time!

Do this. Call your grinding wheel supplier and order a wheel containing G-E Man-Made diamond. Test it in actual production in your own shop. You'll see what we mean.



A carbide cutting tool manufacturer—grinding single-point carbide tools—compared 6" x 3/4" x 1 1/4" plain cup wheels, vitrified bond, 120 grit, 100 concentration—dry grinding. In this actual case history the natural diamond wheel removed 37.1 cubic inches of carbide, whereas the wheel containing G-E Man-Made diamond removed 53.4 cubic inches. Superiority of G-E Man-Made over natural? 44 per cent!

METALLURGICAL PRODUCTS DEPARTMENT

GENERAL  ELECTRIC

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CARBOLOY® CEMENTED CARBIDES • MAN-MADE DIAMOND • MAGNETIC MATERIALS • THERMISTORS • THYRISTORS • VACUUM-MELTED ALLOYS

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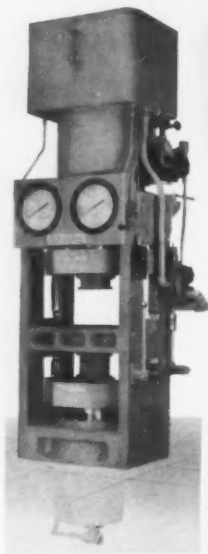
June, 1961

MODERN MACHINE SHOP 51

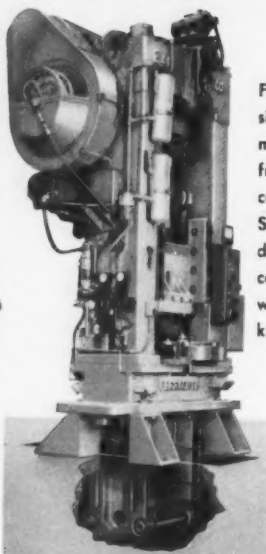
How to produce
POWDERED METAL PARTS
efficiently and economically...
from start . . . to finish



For initial compacting of powdered metals, choose a hydraulic from complete range of tonnages and sizes. 225-ton double ram type compacting press illustrated.



For restriking and sizing, select exact mechanical size from Ferracut's complete line. Shown—400-ton double toggle compacting press with 100-ton lower knockout.



Consult us on efficient methods of press production of powdered metal components.

Since 1863

FERRACUTE MACHINE COMPANY

Builders of Power Presses and Special Machinery
Dept. C, Bridgeton, New Jersey, U. S. A.

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PRECISION CALIPERS

"Celebrating 50 Years of Dependable Measuring"

VERSATILE • TIMESAVING • EASY TO READ

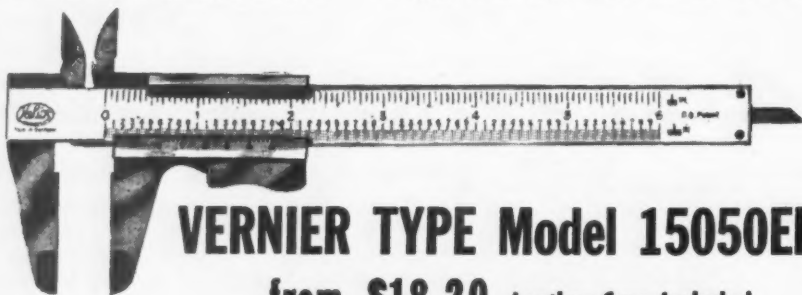


DIAL TYPE Model TUR 68E

Featuring Adjustable Tolerance Dial

from \$38.60 Less Case

- SIZES: 6", 8" AND 10" • STAINLESS STEEL MODELS AT SMALL ADDITIONAL COST
- GUARANTEED ACCURACY TO 0.001" • EVERY MODEL HARDENED THROUGHOUT
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VERNIER TYPE Model 15050EK5

from \$18.20 Leather Case Included

- EASIER READING WITH DOUBLE VERNIER • GUARANTEED ACCURACY TO 0.001"
- NO EYE STRAIN—DULL CHROME FINISH • STAINLESS STEEL



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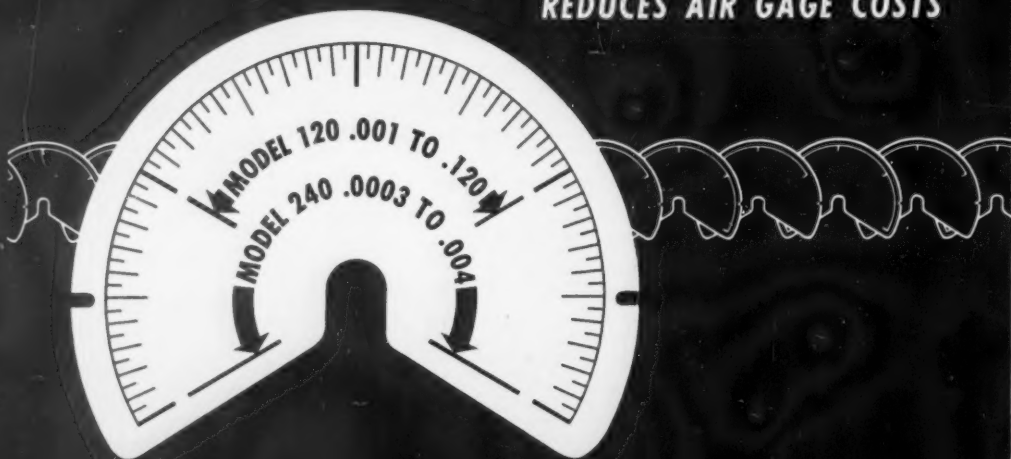
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WISCONSIN—Madison
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ADJUSTABLE MAGNIFICATION

REDUCES AIR GAGE COSTS



PICK YOUR DIAL

- ① 27 STOCK DIALS ON TWO STANDARD MODEL AIR GAGES COVER MAGNIFICATION FROM 35X TO 4,000X OR 2,000X TO 28,000X.
- ① THE GAGE FITS THE JOB. NO COMPROMISE.
- ① CLIP ON DIALS AND EASY ADJUSTMENT ENABLE GAGING SET-UPS TO BE CHANGED IN MINUTES.
- ① EACH AIR PLUG OR AIR RING COVERS A LARGE RANGE OF TOLERANCES AND ZERO POINTS; MANY EXISTING PLUGS AND RINGS CAN BE USED.
- ① ASK YOUR MAN-FROM-STANDARD FOR AN ON THE JOB DEMONSTRATION.
- ① WRITE TODAY FOR OUR NEW AIR GAGE CATALOG #61 AND SPECIAL REPORT "REDUCE AIR-PLUG COSTS — HOW TO DO IT."



STANDARD GAGE COMPANY, INC.

POUGHKEEPSIE, N. Y.

TELEPHONE GROVER 1-3100

WHY WAIT?

SAVE THIS AD FOR CHECKING FUTURE REQUIREMENTS

DELIVERY FROM STOCK

**SPECIAL RH & LH
HIGH SPEED**

TAPS • DIES • THREAD PLUG & RING GAGES

NEW SIZES ADDED
DAILY... IF NOT
LISTED—
WRITE



DEALER
INQUIRIES INVITED

SIZE	THREADS PER INCH
0000	160
000	120
00	90-96-112
0	56-64-72-76-80-90
1	48-56-60-64-80-90
2	48-52-54-56-60-72-80-96
3	36-40-46-44-72-80
4	30-32-38-42-44-56-60-64-72-80-90
5	22-27-30-32-36-38-42-48-50-56-60-64-72-80
6	24-28-30-36-38-42-44-48-56-60-64-72-80
7	28-30-32-34-36-38-40-44-48-64
8	24-26-28-30-38-40-44-48-56-64-72-80
9	24-28-30-32-36-40
10	18-20-22-26-28-30-34-36-40-56-60-64-72-80-96
11	20-22-26-27-30-32-36-40
12	20-22-26-27-30-32-36-38
13	48-56-60-64-72-80
14	20-22-24-28-32-40
15	14-16-18-26-28-30-32-36-40-64
16	18-20-24-28-32-40
17	16-18-20-22-24-28-32-36-16-20
18	16-18-20-22-24-28-32-36
19	16-18-20-22-24-32-40
20	18-20-24
21	14-16-18-20-24-32
22	16-18-20-24
23	14-16-18-22-24
24	14-16-20-24
25	14-16-32
26	14-16-30
1/16	56-60-64-72
5/64	56-60-64-72
1/32	32-36-38-40-56-60-64
100	100
107	107
7/64	36-40-42-44-48-50-56
1/8	30-32-36-38-40-48-56-60-80
1/32	50
9/64	30-32-38-40
1/40	38
5/32	24-26-28-30-32-36-38-40-50
11/64	24-26-30-32-36-38-40
1/16	12-18-20-22-24-26-27-28

SIZE	THREADS PER INCH
3/16	30-32-36-40-48-56-64-72
1/8	24
13/64	24-28-30-32-36-40
7/32	20-22-24-26-27-28-30-32-36-38-40-56-60-64-72
1/4	22-24
15/64	20-22-24-28-32-36-246-40
246	40
1/4	10-12-14-16-18-22-24-26-28-30-32-36-38-40-48-50-56-60-64-72-80
17/64	12-18-20-24-27-28-32-40-48-60-72
277	40
9/32	16-18-20-24-26-27-28-32-36-40-56
19/64	300
5/16	10-12-14-16-20-22-26-27-28-30-32-36-40-44-48-50-56-64
21	64
11/32	16-18-20-24-26-27-28-32-36-40-64
23/64	16-24
365	28
3/8	10-12-14-18-20-22-26-27-28-30-32-36-40-44-48-56-64-72
25	64
13/32	12-14-16-18-20-24-27-28-32-36-40
27/64	14-20-24-28-32-36
7/16	10-12-16-18-22-24-26-27-28-30-32-36-40-46-56
29/64	12-14-16-20
15/32	12-14-18-20-24-27-28-32-36-40
31/64	13-20-24-32
1/2	10-12-14-16-18-22-24-26-27-28-30-32-36-40-44-48-56-70-72-80
33/64	12-13-20-24
24	550
9/16	10-13-14-16-20-24-26-27-28-30-32-36-40-48-56-80
37/64	10-12-18-20-27
19/32	12-18-20-24-28-32-36-40

SIZE	THREADS PER INCH
5/8	9-10-12-13-14-16-20-24-26-27-28-30-32-36-40-48-54-64
41/64	11-18-24-32
21/32	10-11-18-20-24-27-32-40-48
564	32
11/16	10-11-12-14-16-18-20-22-24-26-27-28-30-32-36-40
23/32	11-12-16-18-20-24-27-32-36-40
47/64	10-12-16-18-20
3/4	6-8-9-11-12-14-15-18-20-22-24-26-27-28-30-32-36-40-48-60-72
49/64	10-16-18-20
25/32	10-12-16-18-20-24-27-32-40
800	32
13/16	8-10-12-14-16-18-20-24-27-28-32-40
835	6-12
55/64	9-10-18-20-24-27-32-40-48
27/32	8-10-11-12-13-16-18-20-24-26-27-28-30-32-36-40
850	9-12-14-16-20-24-27-28-32
7/8	8-9-10-12-14-16-18-20-24-26-27-28-32-40
29/32	8-9-12-14-16-18-20-24-28-32
15/16	8-9-12-14-16-18-20-24-26-27-28-32-40
31/32	8-9-12-14-16-18-20-24-28-32
1	5-7-9-10-11-12-16-18-20-24-26-27-28-30-32-36-40-48
1/1/32	8-12-14-16-18-20
1/3/64	12-14-16-18-20
1/1/16	7-8-10-12-14-16-17-18-20-24-27-28-32-40
1/3/32	7-8-9-12-14-16-18-20-32-40
1/1/8	8-10-14-16-18-20-24-27-28-32-40
1/5/32	7-8-9-12-14-16-18-20-24-32
1/11/64	18
1/3/16	7-8-10-12-14-16-18-20-24-27-28-32-40
1/1/4	8-10-14-16-18-20-24-27-28-32-40
1/5/16	6-7-8-10-12-14-16-18-20-24-27-28-32-40
1/3/8	5-8-10-14-16-18-20-24-27-28-32-40
1/13/32	12-16-18-20
1/7/16	6-8-10-12-14-16-18-20-24-27-28-32-40

SIZE	THREADS PER INCH
1-1/2	7-8-9-10-13-14-16-18-20-24-27-28-32-40
1-17/32	7-12-16-18-20
1-9/16	6-8-10-12-14-16-18-20-24-32-40
1-5/8	5-5 1/2-6-8-10-11 1/2-12-13-14-16-18-20-24-27-28-32-40
1-11/16	8-10-12-14-16-18-20-24-32
1-23/32	5-8-12-14-16-18-20
1-3/4	6-8-10-12-14-16-18-20-24-32-40
1-7/8	18
1-17/16	12
1-13/8	10-12-14-16-18-20-24-32
1-7/8	5-8-10-12-14-16-18-20-24-32
1-29/32	12-16-18-20-32
1-15/16	8-10-12-14-16-18-20-24-32
2	4 1/2-6-8-10-12-14-16-18-20-24-32
2-1/16	8-10-12-14-16-18-20-24-32
2-1/8	4 1/2-8-10-12-14-16-18-20-32
2-3/16	8-10-12-14-16-18-20-24
2-1/4	4 1/2-8-10-12-14-16-18-20-32
2-5/16	8-10-12-14-16-18-20-24
2-3/8	4-8-10-12-14-16-18-20-32
2-7/16	6-8-10-12-14-16-18-20
2-1/2	4-6-8-10-12-14-16-18-20
2-9/16	8-10-12-14-16-18-20
3-3/8	4-8-10-12-16-18-20-32
2-11/16	8-10-12-14-16-18-20-32
2-3/4	4-8-10-12-14-16-18-20-32
2-7/8	4-8-10-12-14-16-18-20-24
2-15/16	8-10-12-14-16-18-20-32
3 1/4	4-8-10-12-14-16-18-20
3-1/16	4-8-10-12-14-16-18-20
3-1/8	4-8-10-12-14-16-18-20
3-3/16	4-8-10-12-14-16-18-20
3-1/4	4-8-10-11-12-14-16-18-20
3-1/2	4-8-10-12-16
3-5/8	4-8-10-12-16
3-3/4	4-8-10-12-16
3-7/8	4-8-10-12-16
4	4-6-8-10-12
4 1/8	16
4 1/16	10-12-16
4 1/4	4-8-10-12-16

Many more sizes in stock up to 6" dia.

LEFT HAND N.C. (USS) - N.F. (SAE) SIZES

SIZE	THREADS PER INCH	SIZE	THREADS PER INCH
1	80	1	8
1	64-72	1	10
2	56-64	2	12
1	48-56	1	14
1	36-40-48	1	16
5	40-44	5/16	18-24
5	32-40	3/8	16-24

'OVERSIZE' and 'UNDERSIZE' TAPS

RIGHT AND LEFT HAND N.C. AND N.F. SIZES		
MACHINE SCREW	32 to 35	Plus or Minus .002, .005, .008
MACHINE SCREW	36 to 41	Plus or Minus .002, .005, .010
FRACTIONAL	1/4" to 1-1/2"	Plus or Minus .002, .005, .010
		.015, 1/64, 1/32

Right & Left Hand - Unlisted 'Gun' or Spiral Pointed Taps

Size	Threads	Size	Threads
1	80 NF	7/8	9 NC, 14 NF
2	56 NC, 64 NF	1	8 NC, 12-14 NF
3	48 NC, 56 NF	1 1/8	7 NC, 12 NF
4	36-40-48	1 1/4	7 NC, 12 NF
5	40-44	1 1/2	6 NC, 12 NF
5	32-40	1 3/4	6 NC, 12 NF
5/16	18 NC, 16 NF	1 7/8	6 NC, 12 NF
1/4	19 NC, 16 NF	1 1/2	6 NC, 12 NF

Right Hand - Unlisted 'Pulley' And Extra Length Taps

Size	Threads	Size	Threads
4	36-40 NC, 48 NF	7/8	24 NF
5	40 NC, 44 NF	1 1/8	20 NF
6	32 NC, 40 NF	1 1/4	20 NF
7	32 NC, 36 NF	1 1/2	12 NC
8	24 NC, 32 NF	1 3/4	18 NF
10	24 NC, 28 NF	1 7/8	18 NF
12	24 NC, 28 NF	2	16 NF
14	24 NF		
16	24 NF		
18	24 NF		
20	24 NF		
22	24 NF		
24	24 NF		
26	24 NF		
28	24 NF		
30	24 NF		
32	24 NF		
34	24 NF		
36	24 NF		
38	24 NF		
40	24 NF		
42	24 NF		
44	24 NF		
46	24 NF		
48	24 NF		
50	24 NF		
52	24 NF		
54	24 NF		
56	24 NF		
58	24 NF		
60	24 NF		
62	24 NF		
64	24 NF		
66	24 NF		
68	24 NF		
70	24 NF		
72	24 NF		
74	24 NF		
76	24 NF		
78	24 NF		
80	24 NF		
82	24 NF		
84	24 NF		
86	24 NF		
88	24 NF		
90	24 NF		
92	24 NF		
94	24 NF		
96	24 NF		
98	24 NF		
100	24 NF		

Right Hand 'Pipe' Taps

Size	Threads	Size	Threads
1 1/16	27	1 1/8	27
1 1/4	27	1 1/4	11 1/2
1 1/2	11 1/2	1 1/2	11 1/2
1 3/4	11 1/2	1 3/4	11 1/2
2	11 1/2	2	11 1/2
2 1/2	8	2 1/2	8
3	8	3	8
3 1/2	8	3 1/2	8
4	8	4	8
4 1/2	8	4 1/2	8
5	8	5	8
5 1/2	8	5 1/2	8
6	8	6	8
6 1/2	8	6 1/2	8
7	8	7	8
7 1/2	8	7 1/2	8
8	8	8	8
8 1/2	8	8 1/2	8
9	8	9	8
9 1/2	8	9 1/2	8
10	8	10	8
10 1/2	8	10 1/2	8
11	8	11	8
11 1/2	8	11 1/2	8
12	8	12	8
12 1/2	8	12 1/2	8
13	8	13	8
13 1/2	8	13 1/2	8
14	8	14	8
14 1/2	8	14 1/2	8
15	8	15	8
15 1/2	8	15 1/2	8
16	8	16	8
16 1/2	8	16 1/2	8
17	8	17	8
17 1/2	8	17 1/2	8
18	8	18	8
18 1/2	8	18 1/2	8
19	8	19	8
19 1/2	8	19 1/2	8
20	8	20	8
20 1/2	8	20 1/2	8
21	8	21	8
21 1/2	8	21 1/2	8
22	8	22	8
22 1/2	8	22 1/2	8
23	8	23	8
23 1/2	8	23 1/2	8
24	8	24	8
24 1/2	8	24 1/2	8
25	8	25	8
25 1/2	8	25 1/2	8
26	8	26	8
26 1/2	8	26 1/2	8
27	8	27	8
27 1/2	8	27 1/2	8
28	8	28	8
28 1/2	8	28 1/2	8
29	8	29	8
29 1/2	8	29 1/2	8
30	8	30	8
30 1/2	8	30 1/2	8
31	8	31	8
31 1/2	8	31 1/2	8
32	8	32	8
32 1/2	8	32 1/2	8
33	8	33	8
33 1/2	8	33 1/2	8



This symbol of efficiency can mean much to you

TH Advanced design, precise workmanship, fine materials . . . these are some of the advantages of the Seibert Production Holding Tools, so important as an element of Coordinated Planning.



Floating Holders



Spindle Extensions



Double-Action Tap Drivers



Adjustable Adapters



Recessing Tool Holders



Drill and Tap Drivers

G Seibert Gages and Gage Plates make old presetting equipment obsolete. Size of gage plates drastically reduced by circular design.

S Tool Storage Boards provide space for pre-setting and storing two sets of tooling at the machine, ready for instant installation.

C Seibert Tool Control Units with meters to record the number of machine cycles between tool grinds. They automatically program tool changes.

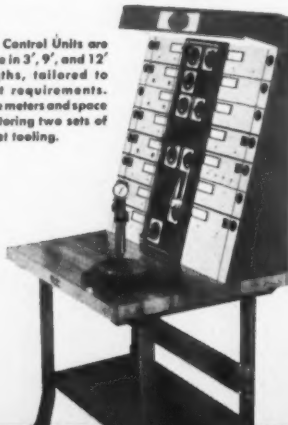


Meter Units for all types of equipment. One to eight meters to program tool changes. Mount on wall or machine.

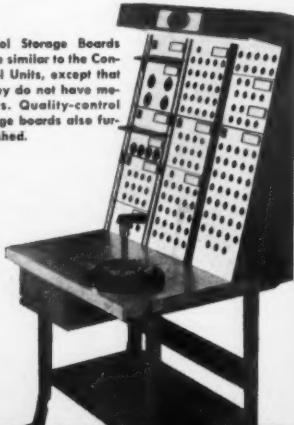


Circular-Type Gage Plates are compact and convenient. One to six holes. Gages have interchangeable heads.

Tool Control Units are made in 3', 9', and 12' lengths, tailored to meet requirements. Have meters and space for storing two sets of preset tooling.



Tool Storage Boards are similar to the Control Units, except that they do not have meters. Quality-control gages also furnished.



T H G S C is not a name, but a combination of initials to represent an idea . . . an *important* idea for production plants which require preset tools for high efficiency, and which are seeking solutions for the following problems: (1) Accuracy and efficiency in presetting, holding, and changing tools. (2) Systematic storage of tools and gages. (3) Dependable and efficient control of tool use to prevent work spoilage, excessive down-time, tool breakage, and machine overload.

T H G S C is the symbol for *Seibert Coordinated Planning*, which is the engineering of a completely coordinated combination of Seibert Tool Holders, Gages and Gage Plates, Storage Units, and Control Units. Such a combination is necessary for operating production metal-working equipment at its highest efficiency and is the key to close teamwork in all operations involved in presetting and changing tools and in the control of tool use.

It is easy to learn of the advantages of *Seibert T H G S C Coordinated Planning*, and the best time to do so is when your production-equipment program is in the planning stage or when you are looking ahead to modernization. But we welcome the opportunity at any time to explain how this coordinated planning can reduce tooling costs, and how systematic storage of tools and gages will promote efficiency among operators and inspectors.

SEIBERT

SEIBERT & SONS, INC.

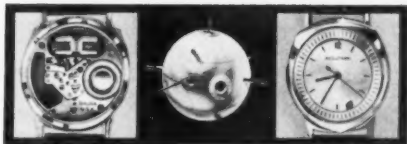
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For more facts write us on Request Card

MORE INFORMATION on Seibert T H G S C Coordinated Planning is yours for the asking. No obligation.

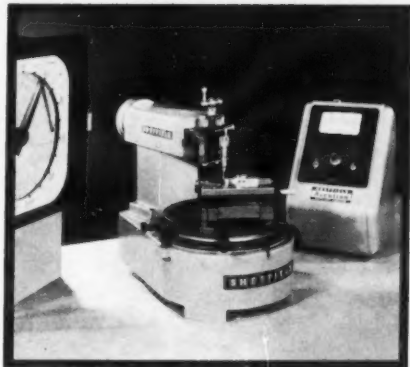
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® GAGING We welcome Bulova's use of the word "Accutron" as a compliment to the term already distinguished in the field of precision measurement. "Accutron," a Sheffield trademark for gaging devices, has long been a symbol of unquestioned accuracy and reliability. The Sheffield Accutron amplifier, for example, can show dimensions down to two and a half millionths of an inch, and is readily adaptable to an almost unlimited range of electronic gaging heads and tooling, for checking almost any dimension, shape, or relationship. Feathertouch gaging heads (with pressures as low as 5 grams) permit reliable measurements of soft or easily distorted parts. Accutron instruments are in constant service in Sheffield's own Eli Whitney Metrology Laboratory.

Your Sheffield representative can give you prompt competent technical assistance in any phase of your gaging needs. Write for the Sheffield catalog on ACCUTRON gages and accessories.



The

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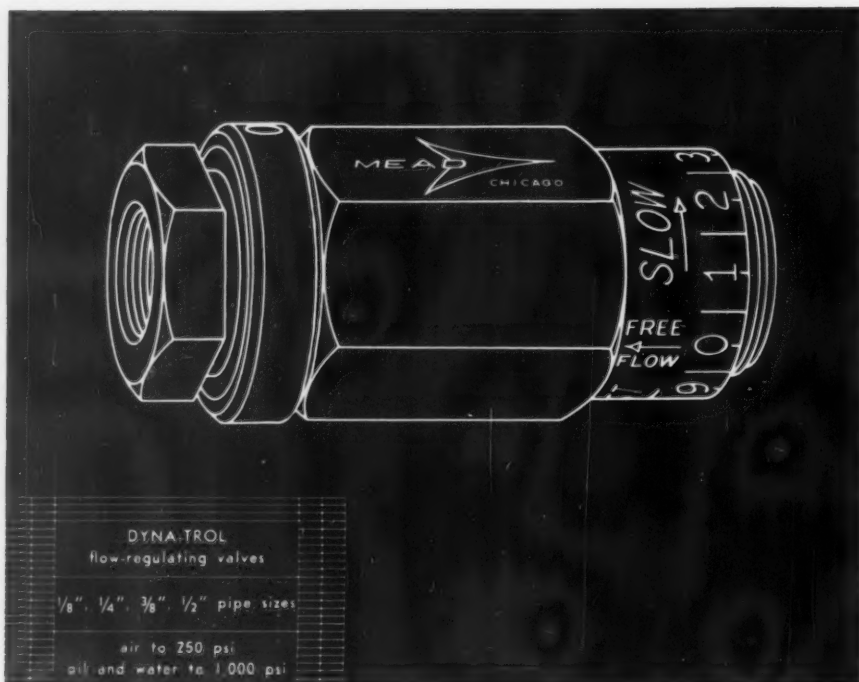
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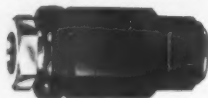
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PROBLEM: how to replace a 1/4" valve with a less-costly 1/8" valve (and get extra precision in low-flow ranges)

SOLUTION: NEW MEAD DYNA-TROL VALVE



Check these design advantages of the new MEAD DYNA-TROL flow-regulating valve:

- Adjusting sleeve—easily rotated by hand—locks to any setting and cannot be accidentally removed from valve body
- Calibrated sleeve records settings for future reference
- Knife-edge variable orifice reduces flow distortion caused by viscosity changes in working medium
- No internal springs to cause malfunction
- All parts rust-proof
- Wide operating range: -40° F. to +250° F.

Small, economical MEAD DYNA-TROL flow-regulating valves can replace more costly valves of larger pipe size. Reason: Internal design permits pneumatic or hydraulic flow equal to full pipe area in both directions. The first 360° turn of the adjusting sleeve increases flow from zero to about 10% of potential—a new measure of precision in low-flow ranges. Successive turns accurately reach 100% of pipe capacity. To cut costs and give exacting control to piston speeds, specify MEAD DYNA-TROL valves to solve your flow regulating problems. For information on quick delivery, write to MEAD today.

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UNIVERSAL R & R DEBURRING TOOLS

with spring-loaded
retractable blade
give precision-cut edge
or chamfer at high
speed without
chatter



Adjustable spring tension allows continuous contact with work-piece to eliminate chatter at high operating speeds. Free-floating blade permits self-alignment and uniform stock removal. Made in a full range of sizes to 1½" diameter.

Blades of the Universal R & R Deburring Tool are made of high speed steel, precision hardened and ground to close tolerances for interchangeability. May be used as horizontal deburrer in portable electric drill or in standard drill press.

For full information, write to Universal Engineering Company.



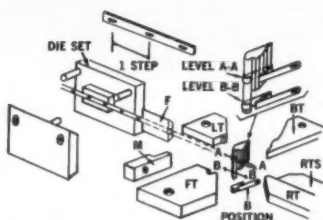
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KEY:

FT Front Tool
LT Left Tool
BT Back Tool
RT Right Tool
RTS Right Tool Secondary
KPT King Post Tool
F Female Cut-off
M Male Cut-off



ELIMINATE SECONDARY OPERATIONS WITH THE NILSON FOURSLIDE

By combining stamping and forming in one FOURSLIDE Machine, miniature, precision electronic spring temper parts are produced at high rates.

A $\frac{3}{16}$ " long Contact Spring of phosphor bronze, 2 Nos. hard (spring temper), is produced on a NILSON Model S-O-F FOURSLIDE at speeds of 350/minute. Tolerances are held to ± 0.0005 " when required. The piercing of the hole in the Contact Spring is done in the Built-in Press of the NILSON S-F Model or in a Model 00 using a standard Horizontal Press Attachment.

The oblong hole in the Contact Spring is pierced in the Die Set (Figure 1). Then ribbon metal is fed into the forming area, where it is formed around the King Post Tool in plane A-A by the side tools (Figures 2-5). In Figure 6, the King Post Tool has been raised to the B-B level, so the Right Tool Secondary can final close the double bend. This $\frac{3}{16}$ " Contact Spring must compress to .032" and spring back to .050", with the sides parallel within .010 T.I.R.

SEVENTEEN MODELS of NILSON FOURSLIDES provide a large versatility to meet



FOURSLIDE operator inserting a die set in a built-in press.

your ribbon metal and wire forming requirements. There are SEVEN S-F and S-T Models with the COMBINATION FOURSLIDE and BUILT-IN PRESS, providing horizontal press capacity from 5 to 75 Tons. Standard NILSON Press Attachments rated $\frac{1}{2}$ to 7 Tons, for NINE of their TEN Wire Forming Machines, also can be used for additional press capacity on the S-F Models.

Full explanation of the NILSON FOURSLIDE PROCESS and tooling examples NOW available in the NEW NILSON "Design & Tooling Handbook". Write for your copy today.



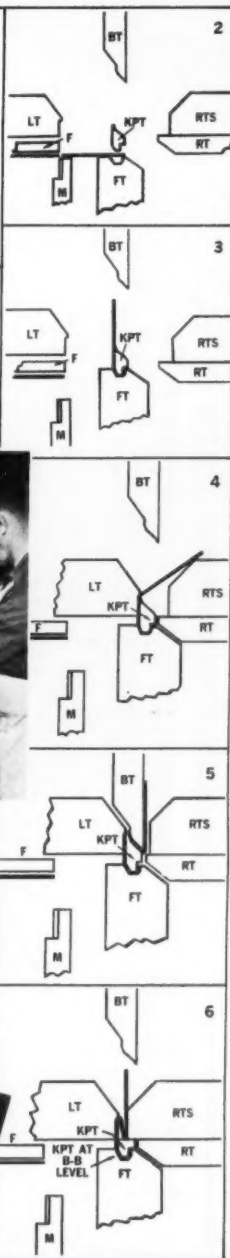
NILSON

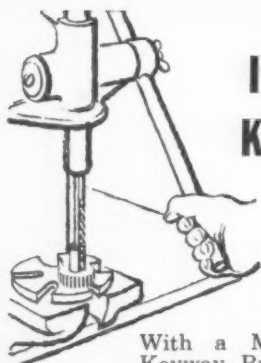
The A. H. NILSON MACHINE CO.
627 Bridgeport Avenue, Shelton, Connecticut

For more data circle 366 on Postpaid Card

June, 1961

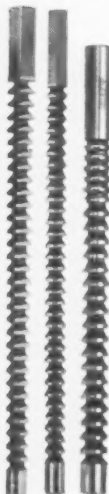
MODERN MACHINE SHOP 63





INSTANT KEYWAYS

With a Minute Man® Keyway Broach you can cut a keyway, by hand, in an arbor press in *one minute* for as little as *one cent*. Available individually or in kits complete with broaches, bushings, shims and keystock. For keyways from $\frac{1}{16}$ " to 1" in any bore $\frac{1}{4}$ " to 3".



A B C

Minute Man®

(A) SQUARE BROACHES

For finishing $\frac{1}{8}$ " to 1" square holes in one pass in cast or drilled bore. (32nd sizes, too)

(B) HEXAGON BROACHES

For finishing $\frac{1}{8}$ " to $\frac{3}{4}$ " hexagon holes in one pass in cast or drilled bore.

(C) ROUND BROACHES

For finishing $\frac{1}{4}$ " to 1" round holes in one pass in drilled bore.



The duMont Corp., Greenfield, Mass.

MAIL FREE BROACH CATALOG AND PRICE LIST S describing Square, Hexagon Broaches, Production Type Keyway Broaches and Keyway Broach Kits to

Name

Company.....

Address

duMont

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Meetings

Important Meeting

Dates

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

JUNE 5-7 • American Society for Quality Control, Annual Convention and Exhibit, Sheraton Hotel, Philadelphia. Society headquarters: 161 W. Wisconsin Ave., Milwaukee 3, Wisconsin.

JUNE 6-8 • Instrument Society of America, Summer Conference and Exhibit, Toronto, Ont. Society headquarters: 313 Sixth Ave., Pittsburgh 22, Pennsylvania.

JUNE 8-9 • Malleable Founders' Society, Annual Meeting, Broadmoor Hotel, Colorado Springs, Colo. Society headquarters: 781 Union Commerce Bldg., Cleveland 14, Ohio

JUNE 11-15 • American Society of Mechanical Engineers, Summer Annual Meeting, Statler-Hilton Hotel, Los Angeles. Society headquarters: 29 W. 39th St., New York 18, New York.

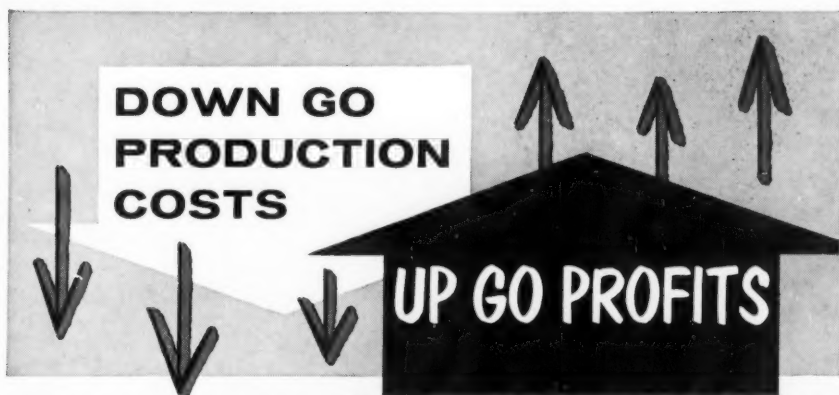
JUNE 14-17 • Drop Forging Association, Annual Meeting, Greenbrier Hotel, White Sulphur Springs, W. Va. Society headquarters: 1121 Illuminating Bldg., 55 Public Square, Cleveland 13, Ohio.

JUNE 16-19 • National Association of Metal Finishers, Annual Meeting, Statler-Hilton Hotel, Boston. Society headquarters: 11 Park St., Montclair, New Jersey.

JUNE 18-20 • Alloy Casting Institute, Annual Meeting, Homestead Hotel, Hot Springs, Va. Society headquarters: 1001 Franklin Ave., Garden City, New York.

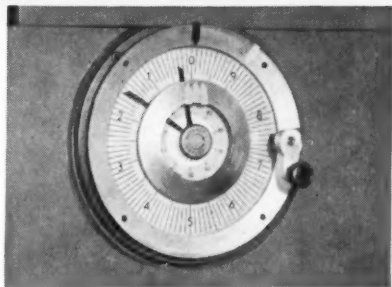
JUNE 18-23 • American Electroplaters Society, Annual Convention, Statler-Hilton Hotel, Boston. Society headquarters: 445 Broad St., Newark 2, New Jersey.

JUNE 25-30 • American Society for Testing Materials, Annual Meeting, Chalfonte-Haddon Hall, Atlantic City, N. J. Society headquarters: 1916 Race St., Philadelphia 3, Pennsylvania.



With the NEW **BULLARD** DYNAMILL H.B.M.

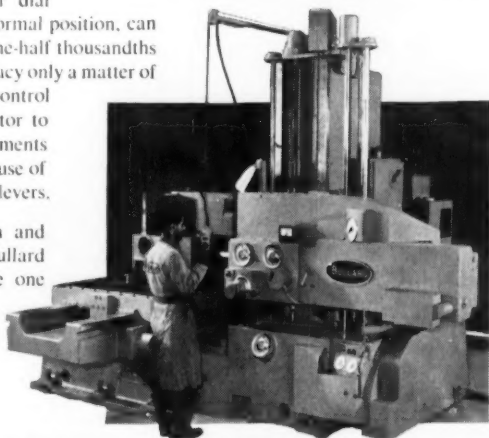
The controls, which have made it possible for Dynamill to reduce non-productive positioning time to a minimum, feature variable traverse rates recorded on large, clock-type dials, and controlled by Bullard's remote control pendant.



Head, table, saddle, and spindle each have a separate three-pointer dial which the operator, from his normal position, can easily read to an accuracy of one-half thousandths of an inch with further accuracy only a matter of simple interpolation. The remote control pendant allows the operator to traverse and position all elements under power without the use of handwheels, cranks or levers.

These and many other design and construction features of the Bullard Dynamill H.B.M. make it the one machine you

*must investigate
before buying any
horizontal boring
machine.*



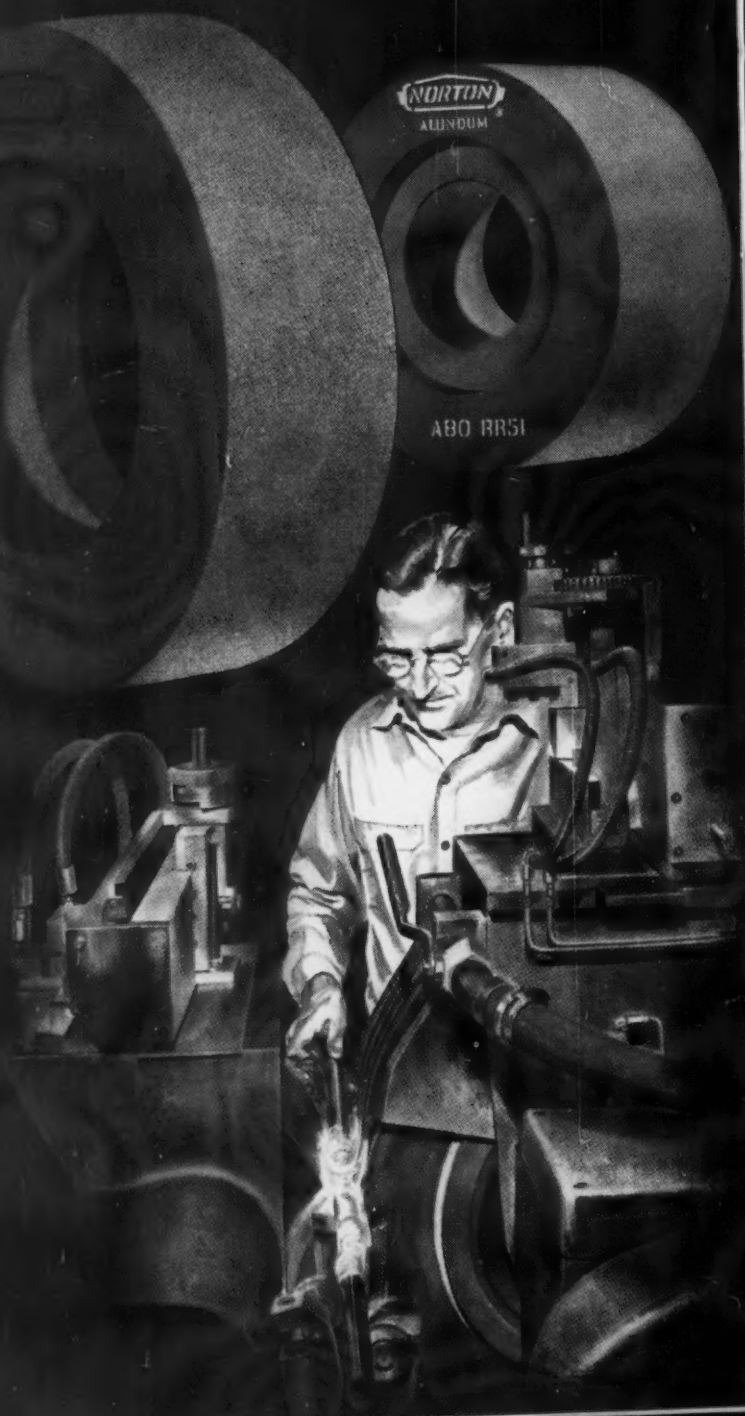
THE BULLARD COMPANY BRIDGEPORT 9, CONN.

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NEW

from

NORTON



The top-ranking wheel team for centerless grinding

The 23 ALUNDUM grinding wheel and R51 feed wheel . . . the best performing, longest lasting combination on any centerless grinder.*

Although centerless grinding is a two-wheel operation, it doesn't need to be a two-brand buying chore.

HERE'S WHY.

Norton now offers this outstanding wheel team for production-precision and economy in centerless grinding . . .

- *The 23 ALUNDUM grinding wheel for premium performance at non-premium price.*
- *The R51 bond feed wheel for positive feed and accurate work support plus long service life.*

23 ALUNDUM Abrasive is no ordinary aluminum oxide. In price it is *non-premium* . . . but with *premium* toughness and sharpness . . . and fast, free cutting action that means *premium* performance.

23 ALUNDUM wheels have other important advantages: friability, which minimizes dressing . . . uniform duplication, for uniform performance . . . and versatility, for grinding all steels, Meehanite, aluminum and many other metals.

Teammate R51 is not just another feed wheel. This special Norton abrasive-and-bond

combination has thoroughly proved the importance of the feed wheel to accurate, low-cost centerless grinding.

Reports from plants all over the country credit R51 wheels with exceptional performance, minimum dressing and no slipping or chatter. And Norton quality control keeps them uniform from wheel to wheel and lot to lot.

On the new Norton No. 2 Straddle-Bearing Centerless Grinder — or on any other machine of this type — 23 ALUNDUM grinding wheels and R51 feed wheels make your best matched team for low cost, volume production centerless grinding. For expert aid in wheel selection, and a test run in your plant, see your Norton Man, a trained Abrasive Specialist, or your Norton Distributor, NORTON COMPANY, General Offices, Worcester 6, Massachusetts. Plants and distributors around the world.

*Trade Mark Reg. U.S. Pat. Off. and Foreign Countries



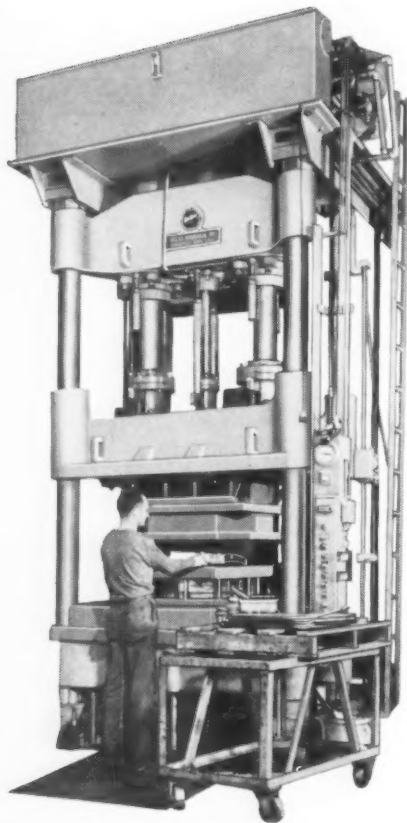
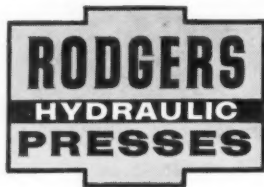
W-2012

Making better products . . . to make your products better

NORTON PRODUCTS: Abrasives • Grinding Wheels • Machine Tools • Refractories • Non-Slip Floors — **BEHR MANNING DIVISION:** Coated Abrasives • Sharpening Stones • Pressure Sensitive Tapes

For more data circle 369 on Postpaid Card

**You get greater accuracy and speed
with**



Good Idea! Write today for complete information on RODGERS Metal Working and Drawing Presses, together with convenient chart showing how easy it is to "design your own." Ask for new Catalog 337.

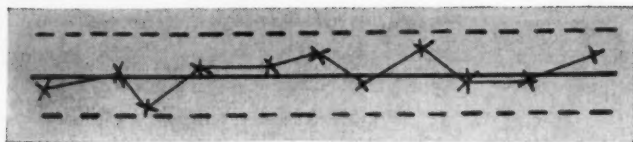
1. You get shock-proof operation with RODGERS exclusive decompression circuit, which gives longer life to hydraulic components, greater accuracy on continuous runs, and faster production.
2. You get the advantage of RODGERS positive-pressure Check Valve, which maintains even pressure in the hydraulic circuit, eliminates excess demand on pump, assures smoother operation and longer machine life.
3. You have a choice of hydraulic circuits, including manual, pressure-sensitive, semi-automatic, or fully automatic control, to give you any desired speed and performance.
4. You have a choice of press frames and platens, in cast alloy steel, ductile cast iron, or fabricated weldments — to suit your requirements.
5. With RODGERS flexibility of design, you may select the exact type metal-working press you prefer for any particular need. Simply specify the capacity, from 50 to 400 tons; the size bed frame, with solid or open bolster; the pump unit and controls needed to give you any desired speed. Actually, you may *design your own press* from the convenient specification tables which we will send you upon request.

HP-100DR

RODGERS HYDRAULIC, INC.

7401 Walker Street • Minneapolis 26, Minnesota

For more data circle 370 on Postpaid Card



*"This is selling
your gages,"*



SAYS THE QUALITY CONTROL MAN
AT A MAJOR AUTO MANUFACTURER.

COMTORPLUG

*Here's
why-*

FITS PERFECTLY INTO THE REQUIREMENTS OF
STATISTICAL QUALITY CONTROL

ACTUAL SIZE Comtorplug indicates the actual dimension, easily readable to .00005".

FIXED READING Not a passing approximation, Comtorplug gives a fixed reading of the actual dimension.

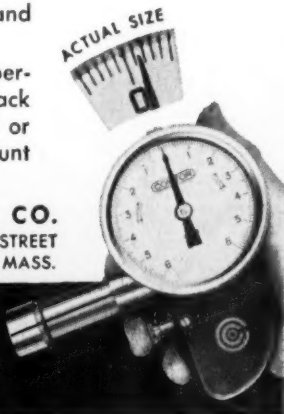
REPEATABLE Built-in features assure that various operators get the identical reading. Comtorplug automatically gives: self-alignment, self-centering and uniform gaging pressure.

2-POINT GAGING Automatic 2-point contact permits taking the diameter at any point, front to back as well as axially. Thus Comtorplug detects front or back taper, ovality, etc., and shows the exact amount of the deviation.

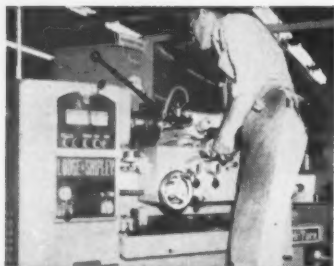
REQUEST BULLETIN 51

COMTOR CO.
64 FARWELL STREET
WALTHAM 54, MASS.

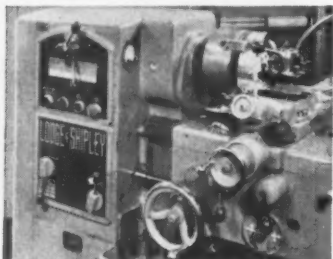
E-X-P-A-N-D-I-N-G PLUG GAGE
FOR HOLES 1/8" to 10" DIAMETER



For more data circle 371 on Postpaid Card



Daimotor Div., Yuba Consolidated Industries . . .
"used in model shop for turning, facing and
boring all sorts of experimental parts."



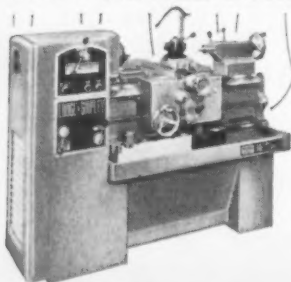
Raytheon Manufacturing Co. . . . "used for
turning, facing and boring operations on brass,
aluminum and steel workpieces."

Over an extremely wide range of American industry . . . for tooling, production, maintenance and experimentation . . . the Lodge & Shipley 1307 HI-TURN (10") Lathe is making a record of true economy. With literally dozens of big lathe features, the HI-TURN is still priced substantially below many lathes having fewer features, less horsepower and lighter construction.

Turn your attention to HI-TURN. Find out why these and many other lathe users are ordering and reordering HI-TURN Production and Tracer Lathes to replace or supplement larger, far more costly lathes. For complete details, request Bulletin 331, The Lodge & Shipley Co., 3058 Colerain Ave., Cincinnati 25, Ohio.

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THEY'RE ALL TURNING TO HI-TURN

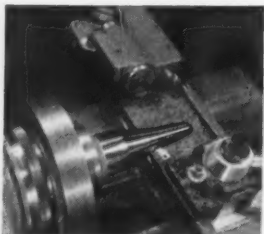


... your Lodge-ical choice

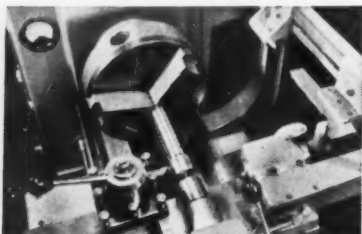
Lodge & Shipley



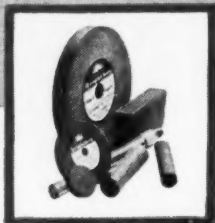
Rocketdyne Div., North American Aviation . . .
"held OD turning to a tolerance of .0003".



Leading glass manufacturer . . . "unheard of economy, ease and speed of production" on machining and reworking glass bottle tooling.



Indiana Gear Works . . . has earned a reputation of "excellent for high production."



CUT RISING COSTS NOW!

Here's the **WORK-SAVING SLANT**
to replace older, costlier methods

Exceptional versatility and adaptability. Looking for cost savings? Simpler, faster production? Improved product quality? Brightboy's abrasive and rubber, functioning simultaneously, achieve a unique working action that constitutes an unusually wide, refreshing concept of abrasive applications . . .

BURRING • CLEANING • FINISHING • POLISHING
in one operation

For All Metals • Wood • Glass
• Fiberglass • Laminated Materials
• Some Plastics

Wide Range of Readily Available
Job-Matched STOCK Textures

Silicon Carbide and Aluminum Oxide grains, extra fine to extra coarse, in soft, semi-firm, firm and tough rubber binders. Wheels, sticks, rods, blocks & points, for machine, manual and automation operations.



For more data circle 373 on Postpaid Card

TIME SAVING FEATURES

Works to close tolerances
Can be shaped to contour
Produces conventional and special finishes and patterns, frequently the final polish.
No before-use preparation or dressing
No skilled labor required

START SAVING NOW, as countless Brightboy users are doing! **WRITE FOR BRIGHTBOY'S**

COST SAVING
CATALOG-MANUAL
covering

- ★ Methods & Applications
- ★ Machine Speeds
- ★ Job-Matched Stock
Wheels, Sticks,
Rods, Blocks &
Points
- ★ Wheel Sizes —
Complete Range



BRIGHTBOY INDUSTRIAL DIVISION
WELDON ROBERTS RUBBER CO.

95 North 13th Street • Newark 7, N. J.

*America's Pioneer Manufacturer
of Rubber-Bonded Abrasives*

BOSTON *gear*[®] **QUALITY**

largest selection... $14\frac{1}{2}^{\circ}$ and 20° P.A.
standard stock gears



Off-the-shelf delivery - from local stock

1781 types and sizes $14\frac{1}{2}^{\circ}$ P.A. - 48 to 3 pitch.

782 types and sizes 20° P.A. - 120 to 4 pitch.

Spur, bevel, miter, worm, helical, spiral miter.

Brass, steel, iron, nonmetallic. See Catalog 57.

IN STOCK at your nearby **DISTRIBUTOR**

BOSTON *gear*[®]

© Boston Gear Works, 1961
Quincy 71, Mass.

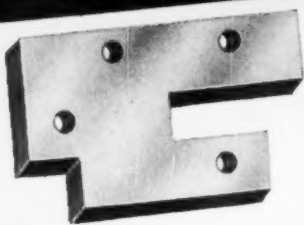
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MACHINE TOOL

MARKING TOOL

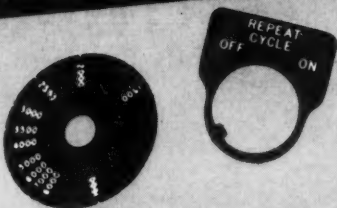
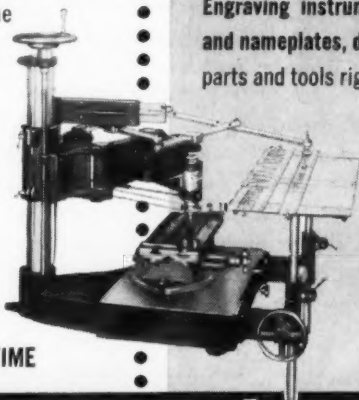
ENGRAVOGRAPH is both!

"The skill is in the tool, not on your payroll"



**Vertical Milling...Profiling...Slotting
...Drilling:** With Engravograph, this shape was profiled and the holes were spotted and drilled in one set-up, from one master template, eliminating expensive tooling, multiple operations on costly equipment.

**MAKE IT IN A
FRACTION OF
THE TIME**



213B

Engraving instrument panels, legend and nameplates, dials, and marking all parts and tools right in your own shop.

**MAKE IT WHEN
YOU NEED IT**

Write on your letterhead
for 28-page catalog FM-8

new hermes

ENGRAVING MACHINE CORP. 154 WEST 14TH STREET NEW YORK 11, N. Y.
IN CANADA 359 St. James Street West Montreal, P. Q.

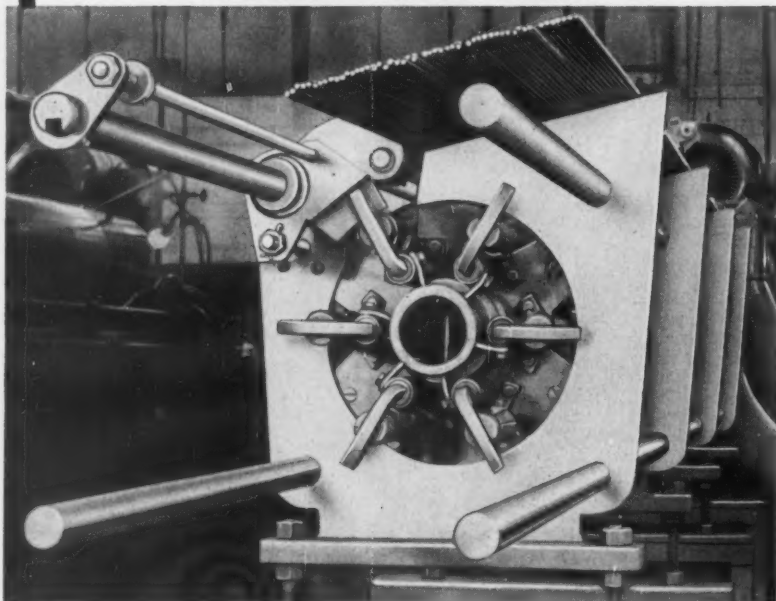
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June, 1961

MODERN MACHINE SHOP 73

AUTOMATIC LOADING

**FOR ALL POPULAR AUTOMATIC
MULTIPLE SPINDLE
SCREW MACHINES**



AUTOMATIC STOCK FEED

- ACRO-FEED automatically reloads in a continuous feeding cycle.
- ACRO-FEED feeds bar stock any length in one instantaneous feed out.
- ACRO-FEED side loading leaves more useable floor space.
- ACRO-FEED ups O.D. capacity by eliminating feed tube.
- ACRO-FEED assures minimum end waste and short pieces.
- ACRO-FEED feed rolls last 6 to 8 times as long as feed fingers.

Can be purchased from National Acme Co.

Write for full data.

ACRO-FEED INDUSTRIES, INC.

18533 WEAVER AVE • DETROIT 28, MICH. • VE. 8-1278

For more data circle 376 on Postpaid Card

**Want to Cut DRILLING
COSTS?**



**Get
INCREASED PRODUCTION
IMPROVED QUALITY
LONGER TOOL LIFE**

with a

Bellows DRILL PRESS FEED

Automatic or semi-automatic feeding of drill press spindles is practical for short runs as well as long with the Bellows Drill Press Feed. Attaches quickly to the star wheel shaft of any drill press. A touch on the starting control handle advances the drill rapidly to the work, hydraulically feeds through the work, automatically returns spindle to start position. Air-powered (operates on any air pressure between 15 and 150 lbs.), electrically controlled. Precision hydraulic feed is quickly adjustable to any tool working in any material. Can be moved from one drill press to another in minutes.

656C-3

Get complete specs on the Bellows Drill Press Feed. Write today for free Bulletin DF 110R. Address Dept. MMS 661, Bellows-Valvair, Akron 9, Ohio.

Bellows-Valvair

AKRON 9, OHIO

DIVISION OF INTERNATIONAL BASIC ECONOMY CORPORATION (IBEC)

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June, 1961

MODERN MACHINE SHOP 75

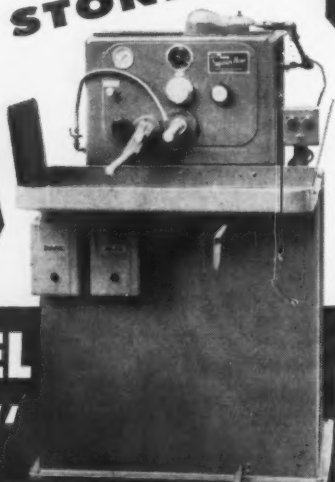
**Let Superior
Help you—**

**SHORTEN
HONING TIME**

**ACHIEVE A
BETTER FINISH**

**CUT
PRODUCTION
COST**

**EXTEND
STONE LIFE**



**MODEL
"HM"
HONEMASTER**

Adjustable hydraulic system assures constant stone pressure, continuous cutting with no fall off due to wear or stock removal.

Infinitely variable speed (250 to 1150 rpm).

Single control dial shows when first piece is coming to finish size. Set, then thereafter just compensate for stone wear.

Hydraulic clutch and brake.

**Stocked in all principal
cities. Send for details and
prices.**

SUPERIOR HONE CORPORATION

1009 TENNESSEE ROAD

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ERWIN, TENNESSEE

*Ever see a
magnetic chuck
hold non-magnetic
materials?*

Magna-Vise

makes it easy!

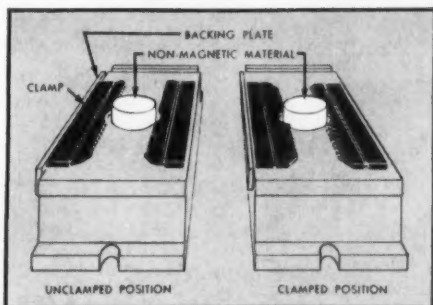
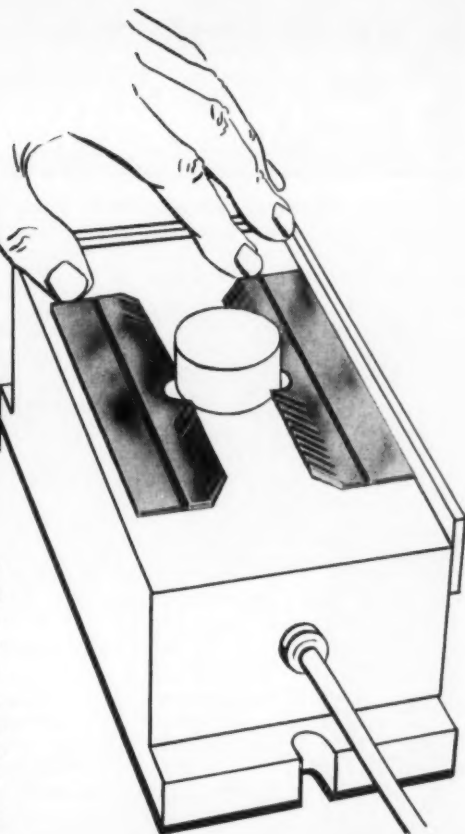
Helps you get more use from your magnetic chucks. Lets you use them to hold all kinds of non-magnetic materials. Eliminates cumbersome fixtures, reduces set-up time and costs.

Here's all you do: (1) Place Magna-Vise on de-energized chuck. (2) Place work-piece between Magna-Vise jaws. (3) Energize chuck. Magna-Vise jaws drawn down against chuck surface and sides of work-piece, hold it rigidly in place. (4) To remove piece, de-energize chuck.

Once you've used Magna-Vise you won't want to be without it.
ORDER YOURS TODAY.

Patent No. 2477297

Model	Length	Width Jaws	Thick	Price
6	6 $\frac{3}{8}$ "	1 $\frac{1}{4}$ "	$\frac{3}{8}$ "	\$32.00
6A	6 $\frac{3}{8}$ "	1 $\frac{1}{4}$ "	$\frac{1}{16}$ "	\$35.00
10	10"	1 $\frac{1}{4}$ "	$\frac{3}{8}$ "	\$42.00
14	14"	1 $\frac{1}{4}$ "	$\frac{3}{8}$ "	\$60.00



MAGNA-LOCK INC., Big Rapids, Mich.

For more data circle 379 on Postpaid Card

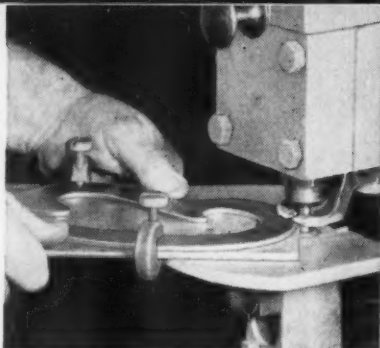
For fast, economical cutting of flat metal shapes there are **7** MODELS OF **Campbell Nibbling Machines**

...with cutting capacities ranging from 3/32" mild steel for **MODEL O** machine to 1/2" mild steel for **MODEL 530**, in sheet sizes from 16" or less, to 72".

CAMPBELL NIBBLERS are making tremendous savings in time and money for hundreds of users in aircraft and other metal-working plants.

...in fast cutting of ferrous and non-ferrous sheet metals or composition sheets.

...for moderate production runs or experimental development work.



Economical
"throw-away"
punch and die



Send for this catalog for complete information on this versatile production and experimental tool

• **CAMPBELL NIBBLERS** cut from 40 to 60 times faster than drilling or filing. A fast-moving punch (350 to 900 strokes per minute) operating over a die, nibbles out the design, taking a small "bite" with each stroke of the punch.

- ...for any and all kinds of shapes
- ...for either inside or outside cuts
- ...with no distortion of material—no internal strains—no invisible fractures—no burr
- ...with a "nibbled" edge that is sufficiently smooth to require very little finishing and sometimes none

CAMPBELL standard punches are made double end to double work life and halve the cost. Prices are so low (starting at 40c each, or 20c per working end) that new punches cost less than regrinding dull ones.

Here is a quick picture of **CAMPBELL NIBBLING MACHINE** Capacities

Campbell Nibbler Model #	Sheet Width	WORKING CAPACITY Sheet Thickness		Strokes per Minute
		Mild Steel	Alloy Steel	
O.....	16"	3/32"	1/16"	900
1A.....	20"	3/16"	1/8"	375-650
430.....	60"	3/8"	1/4"	350-525
436.....	72"	3/8"	1/4"	350-525
530.....	60"	1/2"	5/16"	350-525
2524.....	48"	1/4"	3/16"	375-650
2536.....	72"	1/4"	3/16"	375-650

CAMPBELL NIBBLERS

Wilson Mechanical Instrument Division
AMERICAN CHAIN & CABLE

Dept. 931, 230 Park Avenue, New York 17, N. Y.

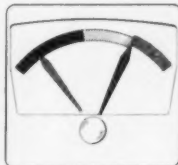
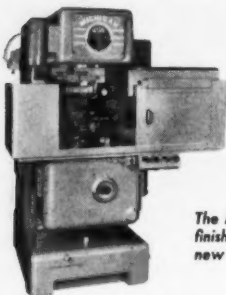
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ACCO



**SOLUTIONS TO GEAR PROBLEMS****WANTED: AUTOMATIC WARNING
WHEN SHAVING CUTTERS
ARE DULL**

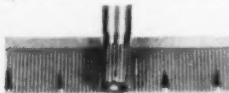
This has been solved in the new Mark II gear finisher. An indicator connected to the cutter drive circuit registers power required to drive the cutter, warns when preset 'dullness' is reached. Device also protects against cutter breakage by dropping the machine knee or warning if an oversize gear should be loaded into the machine. Ask for Bulletin 870-60.



The Mark II gear finisher is full of new features

**WANTED: A SIMPLER WAY TO
PRODUCE SPLINES 'FOOLPROOF'
IN ASSEMBLY**

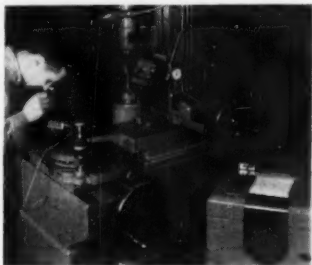
Such splines can be produced without additional operations or time on Roto-Flo machines. A fool-proof double-width index-locating spline tooth is created simply by grinding off one end of the forming rack teeth at the locating point. Incidentally, the Roto-Flo produces such a spline in just a few seconds. Ask for Bulletin RF-60.



A Roto-Flo produces splines, threads, grooves, in one pass

**WANTED: A WAY TO GET RID OF
SETUP AND 'FEEL' ERRORS IN
INVOLUTE CHECKING**

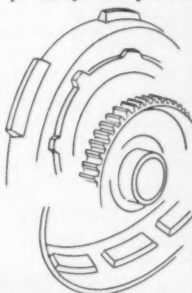
To answer this, we now have available an optical attachment for setting the sine-bar on ANY Michigan Tool #1124 involute checker. Remarkably fast and provides greater setup consistency for increased accuracy. Ask for Bulletin 1124-60.



Fast optical sine-bar setting on an 1124 involute checker

**WANTED: A SINGLE PROCESS FOR
CUTTING ALL KINDS OF
INTERRUPTED TOOTH FORMS
IN DIFFERENT MATERIALS**

We already had the answer to that: the Shear-Speed gear shaper. This machine will cut practically any peripheral shape—spur involute and straight teeth, interrupted or not, cam forms, ratchets, etc., in steel, cast iron, aluminum, and even plastics—in a small fraction of the time required by other processes. Ask for Bulletin 3000-60.



(above) A few of the many shapes produced in one plant by the Shear-Speed



MICHIGAN TOOL COMPANY, 7171 E. McNICHOLS RD., DETROIT 12, MICHIGAN

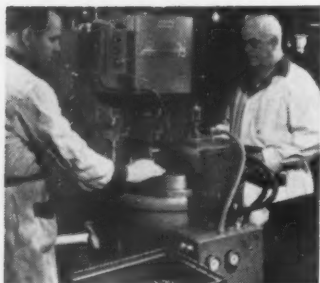
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How **STEWART-WARNER**
produces 220 different assemblies on
one **DENISON** Multipress and saves...

MONEY



COST-SAVING versatility was a key requirement on this pressing job. To produce assemblies for a new product line, Stewart-Warner's Alemite Division needed a press set-up that could handle up to 220 different assemblies. And because of the short runs involved, fast changeover with minimum downtime was a must. *Installation of just one Denison hydraulic Multipress filled the bill.*

This Denison Series "R" 6-ton bench press, equipped with automatic index table and special "quick-change" tooling, assembles from 600 to 850 assemblies per hour. Finished parts are uniform, high-quality ... *no rejects.* And tooling changes can be made in minutes to accommodate the full range of 220 different types and sizes.

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What's *your* problem? Ask the nearby Denison Production Specialist about a Multipress Analysis Program in your plant now. It can **MAP** new ways to cut your costs, get better quality finished products.

THIS NEW SERIES
"R" MULTIPRESS
assembles 220
different assemblies
and prepares them for
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HYDRAULIC MULTIPRESS

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- B—Composite Die Sections
- C—Heel Block
- D—Center Clad
- E—Flange Slide

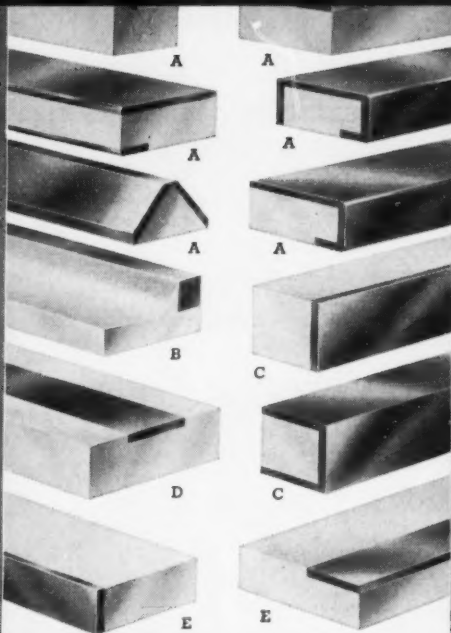
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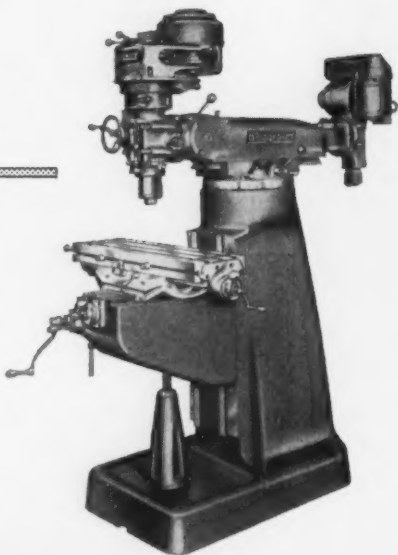
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Whatever the operation on this versatile machine or the class of work, precision is maintained at all production speeds. That is why it is so universally accepted for tool room or production line where close tolerances are required at low production costs.

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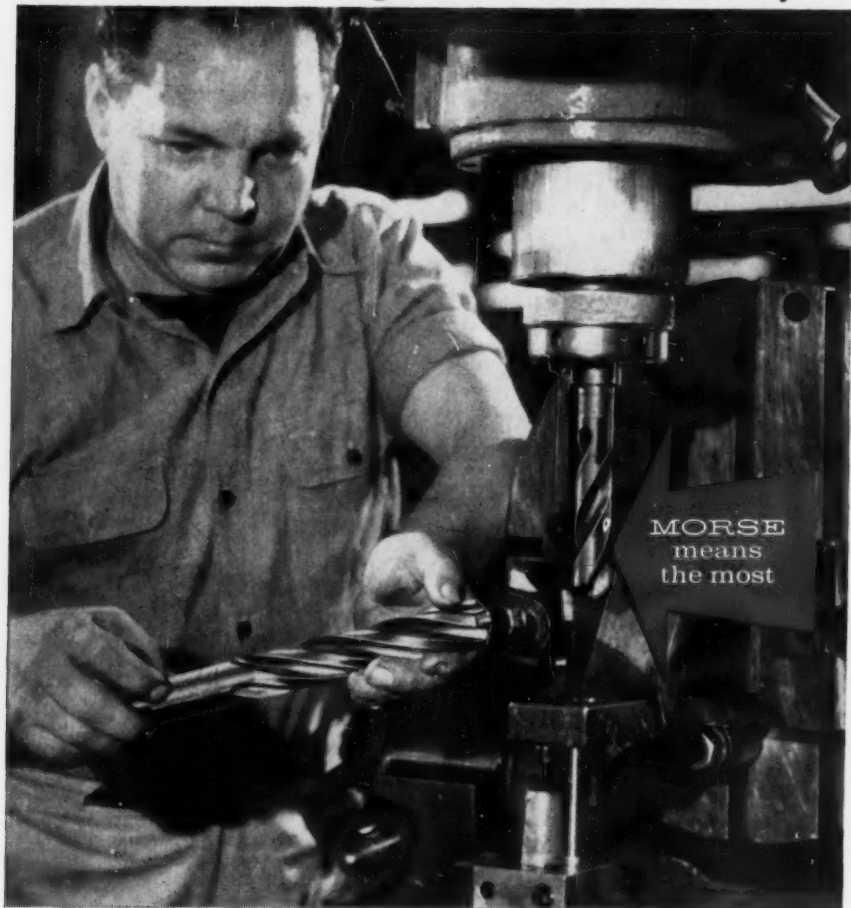
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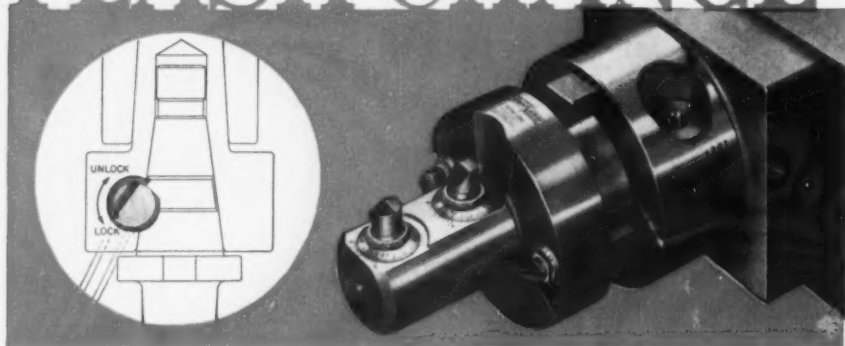
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June, 1961

MODERN MACHINE SHOP 83

microbore
the precision
cutting tool
system
with

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Patented Flash-Change is another exclusive MICROBORE feature. It's DeVlieg's own system of quick change tooling for all makes and types of boring machines, milling machines, turret lathes and automated equipment. The system consists of a Flash-Change tool holder to suit the individual machine spindle and MICROBORE tooling with Flash-Change taper shanks. Clockwise rotation of an eccentric cam in the tool holder locks the cam into an NMTB taper socket in the tool shank. A counter-clockwise motion unlocks and ejects the tool. Tooling is interchangeable from one machine to another or can be reused in the same machine without resetting. Write for complete information on Flash-Change and other developments of the MICROBORE system of precision tooling.

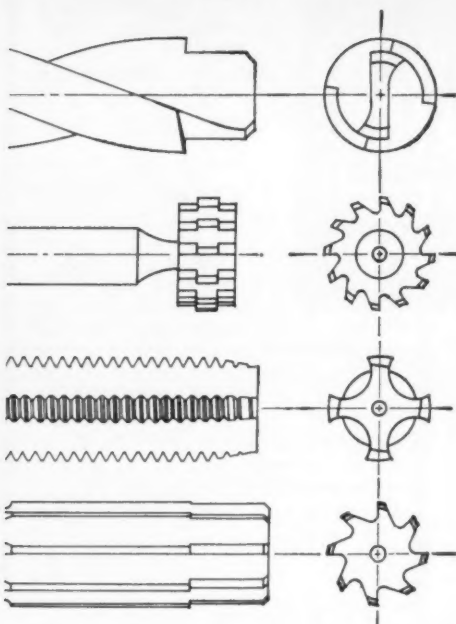
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It's a story of better work, better finishes, elimination of extra operations.

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It's a story of grinding shapes such as cams from the solid, faster and at less cost than machining and finish grinding.

Basically, it's the story of form relief grinding made practical by R-O so that every shop can enjoy its advantages. Let us send you the story.

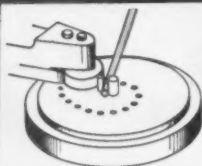


R-O Manufacturing Company
31171 Stephenson Highway
Madison Heights, Michigan

Please forward the R-O catalog

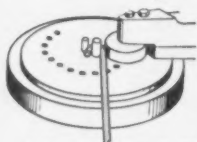
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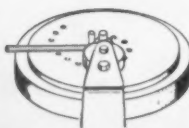


1 OFF CENTER EYES

Insert bar stock between Locking Pin and Radius Pin of desired size.



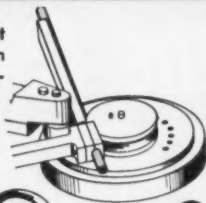
2 Set Forming Roller against material and advance Operating Arm.



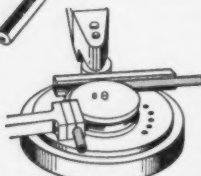
3

Complete operation with one steady movement.

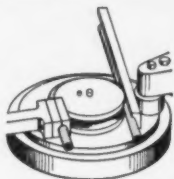
Clamp tube. Insert Follow Block between material and Forming Roller.



1 TUBING



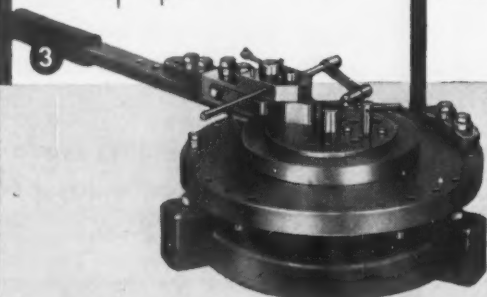
2 Advance Operating Arm until it strikes Angle Stop.



3

Remove Follow Block, release clamp and remove tube.

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June, 1961

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MODERN MACHINE SHOP 87

OVER THE EDITOR'S DESK



FRED W. VOGEL

THE MOORE GUARANTEE

Only a few short months ago, the motoring public was startled by the announcement made by the Ford Motor Company, and then followed by several other auto manufacturers, to the effect that 90-day warranty periods were being extended to a full twelve months. Quality of product as a result of quality materials and workmanship appeared to be the basis for enabling auto manufacturers to make such an offer.

Quality of product, as anyone acquainted with the field of metal manufacturing could quickly point out, is largely dependent upon the quality of the machine tools upon which the product is built. It is therefore perhaps not so startling to find many manufacturers of tools who are willing to issue lengthy guarantees on their machine tools.

What is rather startling, however, is the realization of the extent to which a manufacturer such as Moore Special Tool Company, through its president Richard F. Moore, is prepared to back up its product. Perhaps some reader will provide evidence to prove otherwise, but throughout our own personal experience as well as extensive reading we never before have seen a comparable offer . . . an offer which now guarantees that the basic locating features of the Standard No. 3 Moore Jig Borer and No. 3 Moore Jig Grinder will not wear or deviate in normal use beyond published tolerances over a 10-year period . . . and these tolerances range, depending upon the part, between 20 and 50 millionths.

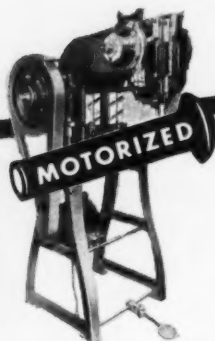
Can anyone expect more than a 10-year guarantee?

SUB ORBITAL

By the time this issue reaches your hands most Americans probably will be referring to the historic May 5 accomplishment in characteristic blase

Why *Chicago Rivet* Offers **TWO METHODS** for **Clinching Semi-Tubular Rivets**

It is part of a widening service based upon industry's recognition that an assembly held together by semi-tubular rivets has great inherent strength and is usually lowest in production cost.



The Chicago Rivet **MOTORIZED AUTOMATIC RIVET SETTER** produces a sharp, solid blow that immediately upsets the tubular section. This method is used on 95% of all applications involving metals or non-fragile materials.

The Chicago Rivet **AIR-POWERED RIVETER** produces a cushioned, shock-free clinch on a tubular rivet, permitting riveting of fragile and uneven materials. This method has greatly widened the use of semi-tubular rivets.



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and split rivets and
25 single and
multiple motorized
automatic rivet
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Over the Editor's Desk . . .

fashion and almost forgotten will be those thousands of men and women in the shops and factories across the Nation who assisted greatly toward making the flight into the outer atmosphere possible. Among these workers are countless production executives who receive and read each month the copies of this magazine and that is the reason we would here pay tribute to them and in some small measure let them know of our appreciation.

No one could have listened to or watched the activities surrounding Astronaut Alan B. Shepard, Jr. on the morning of May 5 without becoming overwhelmed with the feelings of pride and relief. To him we must give great credit but we will also remember to give credit to you, the production executives, in metalworking plants who helped along the way.

THE TAX FRONTIER

Almost everyone in the field of metal manufacturing these days is anxiously watching the National Administration for some indication of what tax relief may be forthcoming. Summing up this attitude is a recent message sent to us by Ludlow King, Executive Vice President of the National Machine Tool Builders' Association. Following is what he wrote.

"President Kennedy has moved in the right direction in recommending to Congress tax incentives to encourage modernization of America's industrial plants and equipment. As the President says, actions are necessary to put more 'go' in our industrial growth.

"He recognizes that this country cannot maintain its lead industrially, unless it constantly modernizes its production lines with modern machinery for production of more goods of higher quality at lower prices. Although more progress has been made in the development of machine tools in the last five years than in the preceding forty, most of the metalworking equipment in operation today is obsolete and the machine tool industry is operating at only about 60 percent of capacity.

"If the Administration and the Congress, working together, can develop effective legislation and related administrative changes to encourage immediate investment in metalworking equipment, expand credit and insurance for export business, and reduce barriers to foreign sales, then, the American machine tool industry could be rapidly revitalized to utilize existing productive capabilities toward modernization."

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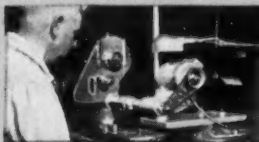
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REPORT FROM WASHINGTON

on events which may effect you and your job.

• **THE BUSINESS UPTURN IS NOW PICKING UP SPEED.** You can see this quite clearly in steel and auto output, industrial production generally, new home starts, and consumer incomes. By the end of the second quarter, total output of goods and services will be up measurably from the start-of-the-year low. Economists think the improvement will add \$10 billion to the rate of output. The rate of recovery will accelerate in the second half—with step-ups in hiring, consumer buying, business investment, and government spending. Conservative estimates put the gains in total output in the second half at another \$15 billion. A growing minority, though, expects more—maybe \$25 billion.

• **THE RECOVERY WILL DEVELOP INTO A FULL-SCALE BOOM** IN 1962 even if the more conservative estimate for the next six months is the one proving out. This year's gains will generate the preliminary momentum. Currently rising sales will soon be clearing out inventory and encouraging plant expansion. And rising incomes will prepare the stage for a spurt in consumer spending. Much of the push next year will come from consumer purchases of durable goods—autos, appliances, furniture, and homes. This has been a slack area for several years now. But the need to replace so many items and the formation of many new families will swell demand. Further, people are upgrading their desires—two cars, air conditioning, color TV sets. By the end of 1962, the economy will be rapidly approaching a full employment level. Unemployment will be down to within striking distance of Kennedy's goal—4% of the labor force. The economy will be growing at a rate of nearly 4% a year.



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Report from Washington . . .

- **BUSINESS ABROAD IS ALREADY BOOMING**, in contrast to the slack here. Industrial output is high and still rising. Unemployment is generally low. Exports are strong. Things are so good that inflation is a potent threat. Canada is about the only major exception to this trend. It is closely tied to U.S. developments. The number of jobless is high, while output is down. Essentially, the booming times are a world-wide phenomenon. In Europe, business is rolling in France, West Germany, Italy, and Holland. British output is high, but exports are off. In Latin America, business is up in Argentina, Mexico, Peru. In the Far East, the Japanese are making gains. India and Pakistan are gaining in agriculture and industry.

- **CORPORATE PROFITS ARE TURNING UP** this quarter, according to early reports. Company nets will look much better than those of January-March. There are two reasons for this outlook. One is improved sales prospects. The other is the progress that many companies have made in slashing costs. First tabulations show that most lines suffered substantial declines from 1960 during the opening quarter of this year. Increases were racked up by utilities, finance and banking, petroleum, office equipment, and non-rail transportation. Declines were registered in chemicals, coal, drugs, steel, paper, railroads, autos, machinery, and building materials.

- **PRICES OF RAW MATERIALS ARE ON THE RISE** these days, for the most part in response to improving business. Prices will be up 2%, over-all, by year-end. But the gains will vary considerably, from line to line. In some cases, the increases will be slow to start—showing up, to begin with, in disappearance of special concessions. (This may be what happens in steel.) Metals: Look for gains of 1% to 1½% as production goes up. Scrap: Rising metal output—and exports—will lift costs 5%. Lumber: There'll be hikes of 4-5%; inventories are down. Other building materials: Gains averaging 2½% are foreseen.

- **CONGRESS WILL REWRITE KENNEDY'S TAX PROGRAM** this year to fashion it along lines that business would prefer. Congressional tax experts believe some key items will be killed outright. Others will be altered considerably. Indeed, the changes may be so sweeping that the President will veto the bill. Liberalized depreciation to spur investment, is the core of Kennedy's program. He wants to allow a tax credit to firms that step up capital spending. But industry wants formulas that give a break to all—not just those that lift outlay. And Congress seems certain to endorse the

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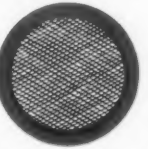
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Report from Washington . . .

latter approach. The outlook for other key sections of Kennedy's tax program: Repealing the dividend credit: This one is considered too touchy, politically, to get through the House or Senate. Withholding taxes on dividends: There's little controversy over this one, but it will pass only as part of a big bill. Taxing foreign income as earned: Congress will refuse to end the deferral of taxes on income kept abroad by U.S. firms. Cracking down on expense accounts: There's little objection but lawmakers doubt whether workable rules can be drafted.

- **YOU MAY SEE SOME TOUGH LABOR NEGOTIATIONS** this year, say government labor experts. They expect union demands to stiffen as compared with 1960. With one eye on the recovery, union leaders want to make up for lost time. But, with improvement only starting, industry can't pay big benefit hikes. Many firms say they will take a strike before they let labor costs inflate. Autos, railroads, farm equipment, and meat-packing will be key trend-setters. Unions are now counting on better breaks from the National Labor Relations Board. For one thing, Kennedy has made two appointments which give the Democrats a majority; the new men are fair but "friendly." For another thing, some recent Supreme Court decisions clipped the Board's powers in cases involving union activity aimed at forcing workers to join.

- **SMALL FIRMS WILL GET MORE PENTAGON BUSINESS** under a program that's being drafted by Defense Secretary McNamara. He hopes to earmark a bigger share of the rising arms budget for companies of eligible size. Altogether, nearly a half-billion dollars more in contracts will be set aside. Quotas are being specified for each service and procurement unit. Procurement officers are being told to keep an eye out for new opportunities for small outfits. Prime contractors are being pressed to give more work to smalls.

- **A NEW AGENCY TO DEAL WITH AUTOMATION PROBLEMS** has been set up in the Department of Labor. It is charged with studying the impact of technology, but it will have practical functions as well. The Office of Automation and Manpower, as it will be known, will also serve as a clearing-house for new solutions to the problem that come out of labor-management negotiations. It will also work through other government agencies to set up or expand ways of retraining or relocating those who are displaced by advancing technology.

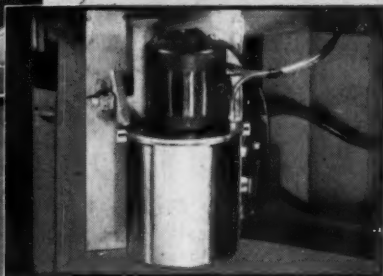
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Consulting Editor, Modern
Machine Shop and author of
"How to Supervise People."

For more than 20 years this writer has been discussing, in various books and articles, a peculiar civil-service-type personnel policy that has been adopted in too many industrial organizations. The initial requirement in such a system is that the supervisor or executive be *popular*.

In February's Reader's Digest there appears a reprint from Personnel, an organ of the American Management Association, which points up this same problem. Its author, Cameron Hawley, is best known for his novels, Executive Suite and Cash McCall.

Hawley's article is based on interviews with a number of top executives and emphasizes a growing opinion that the day for "soft supervision" in our industries is about to be replaced with a realistic appraisal of what it will take to successfully meet the growing menace of foreign competition. These executives believe that, even though we pay higher wages than any other country on earth, we can successfully compete with industry abroad *by keeping our overhead down*. They state that the existing high overhead in foreign plants must inevitably interfere with their ability to take over American markets, providing only that we cut deadwood in our managerial and personnel practices. Particularly they insist that many of highly paid "research departments" need pruning, and add that management "through costly committees" has proved unnecessarily costly.

It is not necessary to look far, in any industrial field, to discover instances of overstaffed managerial and supervisory organizations. My first close contact with this was in the book publishing field, and later in the management of mass-circulation magazines, many of which have already foundered. Somewhere along the line since 1941 it appears that industrial leaders

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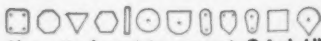
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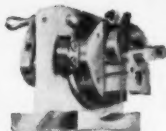
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Supervisory Problem . . .

must, above all else, be *popular* with their subordinates. Thus, as Hawley points out, popularity has become more important than ability to do the job, and in far too many instances responsibility is delegated, not directly to subordinates, but to "committees" or "specialists" in any of a score of fields. All of this adds up to weakening the rightful authority of the supervisor while responsibility is divided between far too many "advisors."

All of this, of course, increases overhead, and the executives Mr. Hawley quotes insist that overhead must be instead cut down. Thus, in checking the masthead of one of our national magazines it appears that 56 editors, associate editors and editorial assistants are required to get out a publication that formerly operated with a staff of 8 or 10 at a time when its advertising revenue was more than three times its present take.

A book company with which I have been dealing for 22 years has increased its managerial staff by several dozens of men, while its gross sales have undergone a shocking reduction. According to Mr. Hawley's article, an agency which specializes in furnishing executives to industry now is receiving frantic calls for executives *who can get results*, regardless of their popularity with the work force.

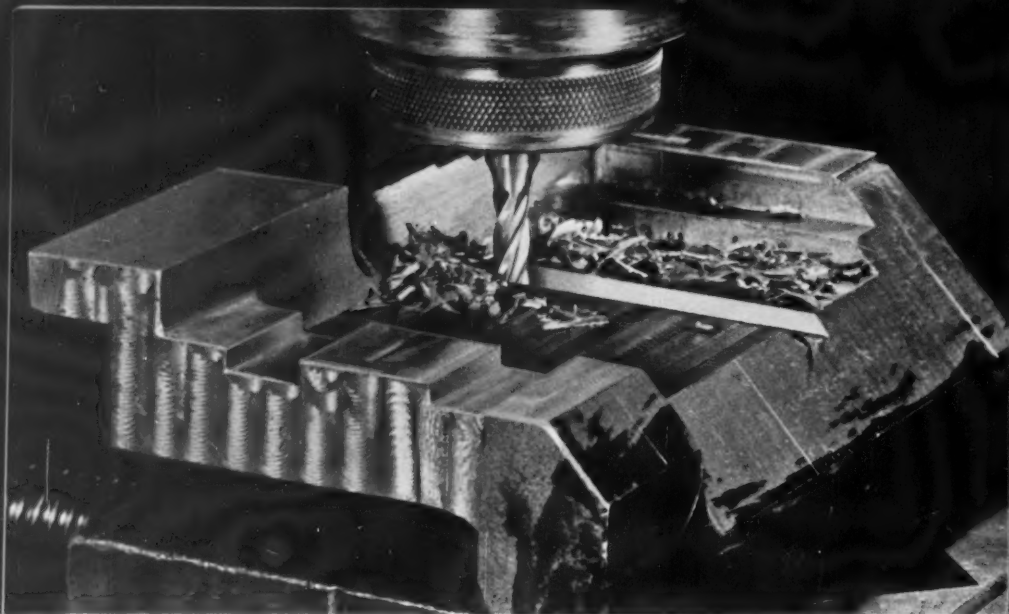
In the long run, sensible supervision of this sort is helpful to the entire organization. The civil-service type of weak supervision has no place in an organization operating under private enterprise. The Reader's Digest article should be carefully studied by everyone who is interested in our survival as a first-rate industrial power and military power in an age when competition from abroad is strengthening yearly. The demand here is obviously not for a return to old-time hard-boiled supervision and management, but rather for an increase in tough-minded leadership which is not in any degree interested in its standing in popularity contests.

Having been employed for many years in governmental bureaus and for many more years in private enterprise, I have noted that the supervisor in private enterprise must get results and keep costs down if he is to retain his job. In public bureaus the supervisor need not consider costs at all, nor production results. In private enterprise a supervisor can remain on good terms with his subordinates, and retain their complete respect, only when he insists that everyone in his organization is putting out a fair day's work.

Oddly enough, such a supervisor finds it possible to do this with no loss in popularity, since an organization of this type can meet foreign competition successfully, and therefore never needs to lay off good workers.



The story behind the chips



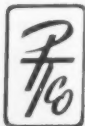
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June, 1961

MODERN MACHINE SHOP 101

ELECTRO-CHEMICAL

Machining of Refractory Alloys

**Author discusses a fast, precise method
for removing metal in producing "buckets."**

By W. B. STEPHENSON, JR.

Manufacturing Engineering Research Laboratory, General Electric Company

Since the time that **Og, the caveman**, first accidentally split one stone against another and found that he could shape wood and other

stones with the sharpened edge, man has been bashing, splitting, grinding and otherwise changing the shape of materials about him. There is no



Fig. 1—View showing typical test sample that has been protected by baked plastisol.

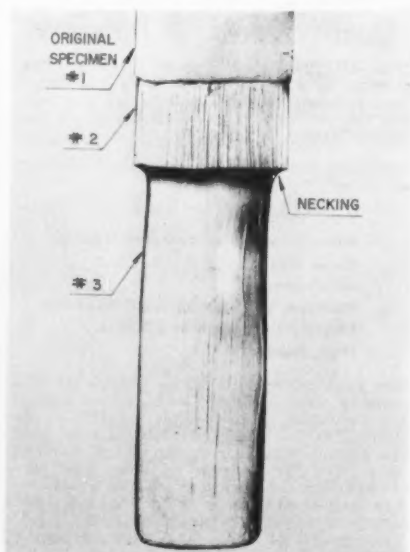


Fig. 2—This illustration shows the results of chemical machining on a 6-inch specimen.

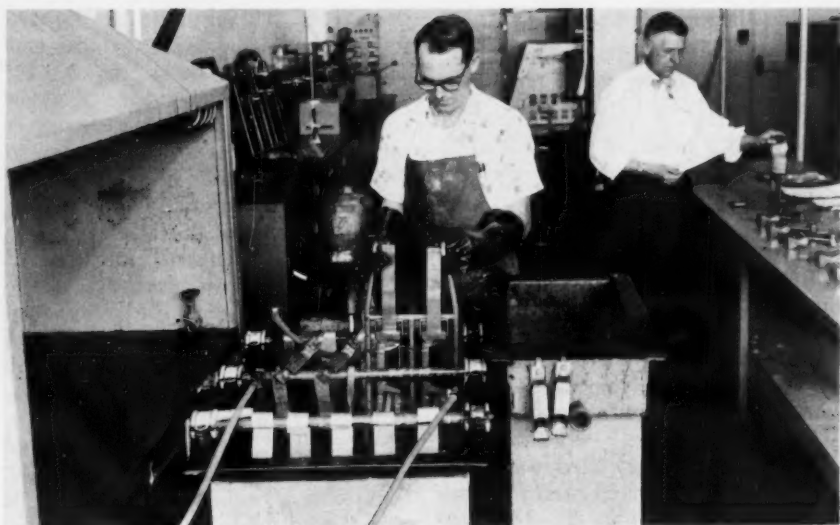


Fig. 3—View of tank with two buckets in position and two more being placed on work rod.

need, here, to trace in detail the many steps of tooling from wood to stone, to bronze, to steel, and back to artificial stone. Suffice it to say that the tremendous strides we have made in our ability to remove large quantities of metal are now being nullified by the production of the so called super-alloys developed to withstand the high temperature stresses of the space age. In many cases we are reduced to early 1900 rates of metal removal.

One of the most recalcitrant of these alloys is M-252. It has the following typical analysis:

Nickel	54.0%
Carbon	0.1%
Chromium	19.0%
Iron	2.0%
Molybdenum	10.0%
Aluminum	0.8%
Cobalt	10.0%
Titanium	2.5%

This alloy was selected for use in making a combination blade and bucket airfoil for a by-pass control test vehicle. The main bottleneck to production of these parts was the slow material removal on the duplicator cycle, particularly in the concave areas. As an example of the cutting rates experienced, the following is typical. At one place near the base of the "bucket" (meaning combination of blade and bucket) it was necessary to make a cut $\frac{3}{8}$ inch deep and $\frac{3}{4}$ inch long. This was accomplished by using a 6-inch diameter milling cutter of 883 Carboloy with a $\frac{3}{4}$ -inch face, at 30 surface feet per minute with a feed of 6 mils per tooth. A sulfurized oil was used as a coolant. After each three parts it was necessary to regrind the tool or as one process engineer stated, "you just sweep up the teeth." The original hardness of this material is Rock-

Electro-Chemical Machining . . .

well C 36-38, but in one pass of the milling cutter it work hardens to C-50-55 to a depth of 1.5 to 2 mils.

It was then decided to try electro-chemical machining methods. This is similar to electropolishing in that the work becomes the positive pole or anode and loses metal to the solution in which it is immersed under the action of a direct current. In the case of electro-chemical machining, high specular brightness is not important, but high rate and evenness of stock removal is.

The first solution tried was a 77 percent sulphuric acid used at room temperature, 140 deg. F., 180 deg. F. and at several different current densities. The optimum was judged to be 140 deg. F. and a current

density of 2.9 amperes per square inch. Figure 1 shows a typical test sample which has been protected by a baked plastisol. The rate of stock removal was 10 mils per hour. A larger section was tried in order to ascertain the effect of removing 50 to 100 mils from a larger area. Figure 2 shows the results on a 6-inch long specimen. Note the accenting, then the smoothing of the forging flow lines as the action proceeds. Arrow No. 2 represents a stock removal of 37 mils in five hours. Arrow No. 3 represents a removal of an additional 100 mils in nine hours. A necking effect occurred at the edge of the masking material. This was a problem that had to be dealt with and which will be discussed later.

Operations were moved to a pilot line where larger tanks and rectifiers were available. Faced with a critical production schedule to meet certain test dates, a faster solution rate was sought. We experimented with several other acids. Hydrochloric (37 percent) removed 12 mils per hour. Concentrated nitric acid (65 percent by wt.) was diluted to 50 percent and 25 percent by weight and tests run at various temperatures and current densities. The 50 percent (by wt.) nitric, when controlled between 80 and 105 deg. F. gave a smooth stock removal of 20 mils per hour, a rate gain of 100 percent. When allowed to become too warm the solution will give off nitrogen dioxide, a brown poisonous gas and the surface of the part will become rough and pitted.

Since we were only going to make a limited run of some 40 parts we used whatever equipment was on hand. This consisted of a small 80

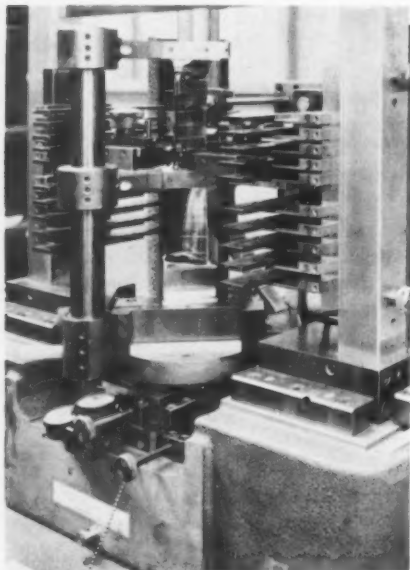


Fig. 4—Bucket in the inspection machine.

gallon Koroseal lined tank, a propeller mixer, and a small tantalum cooling coil. Temporary power lines were run from our plating rectifiers so that the tank could be set in front

of an exhaust hood. It was soon found that one coil was insufficient to maintain the desired temperature and an additional one of 310 stainless steel was added. Although 310

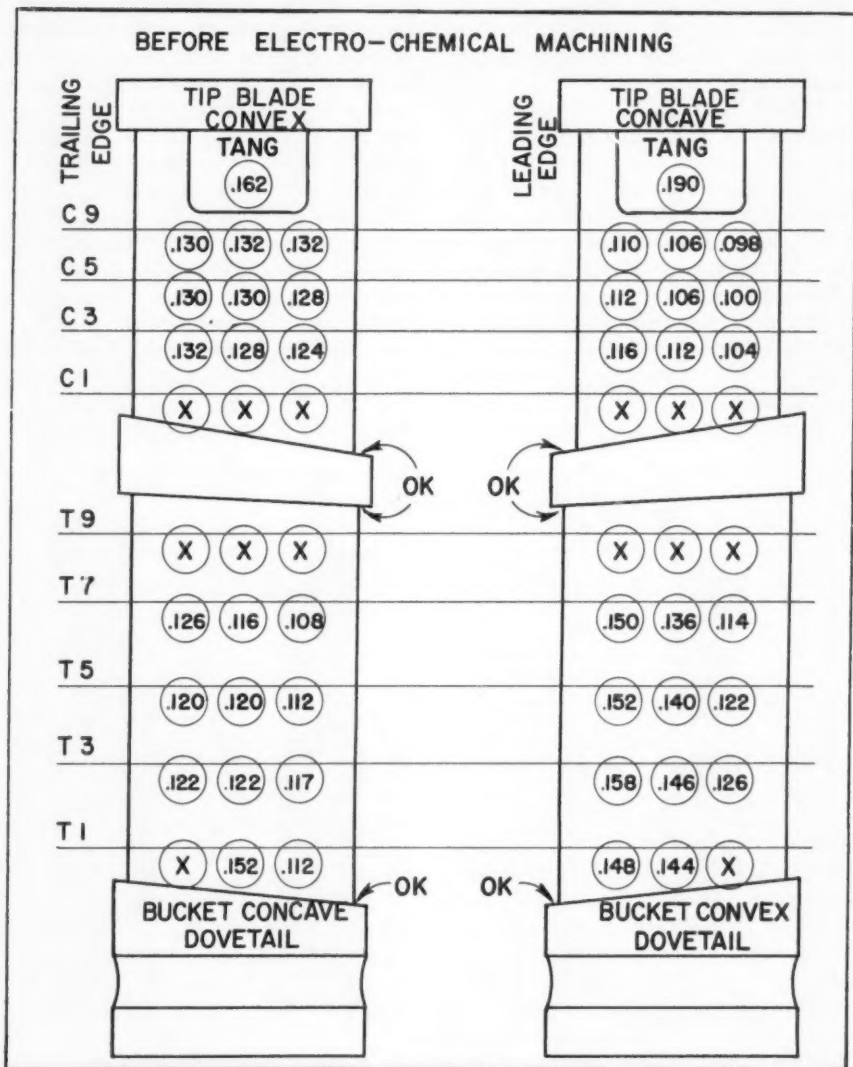


Fig. 5—Typical chart readings to determine where to remove heavy stock to balance envelope.

Electro-Chemical Machining . . .

stainless is usually unattacked by nitric acid, we had continual trouble with erosion and leaking of the stainless steel coils. For any long run we would strongly recommend tantalum coils.

Figure 3 shows the tank with two buckets in position and two more being placed on the work rod. Originally it was decided that the parts would be electro-chemically machined to leave a 40-60 mil envelope on the finished part. Each forging was checked dimensionally at a reference point and we were instructed how much stock to remove overall. It was quickly found that the forging envelope varied from part to part. Variations were from 70 to 195 mils.

It was found necessary to carefully check the entire contour of the part with an Indi-probe inspection machine. Figure 4 shows a bucket in position in this machine. Figure 5 shows a typical chart given to us by inspection. Subtracting 50 from each number told us how many mils of stock were to be removed. We were now able to plot our stock removal by areas. Since stock is removed more rapidly from high areas and projections it was necessary to protect these areas until the proper time. Various methods were tried; electroplating tape, stop-off lacquers, waxes, strippable plastics, and plastisols. The best material for our purpose from a performance standpoint of those tested, was a green plastisol, Unichrome 218X, manufactured by Metal and Thermit Corporation. The

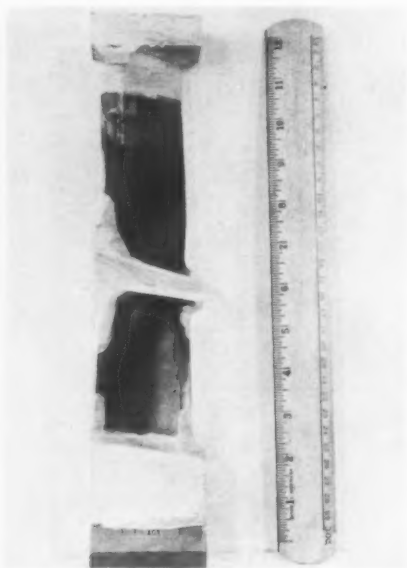


Fig. 6—Certain areas of part are given a prime coat to insure good bond of plastisol.

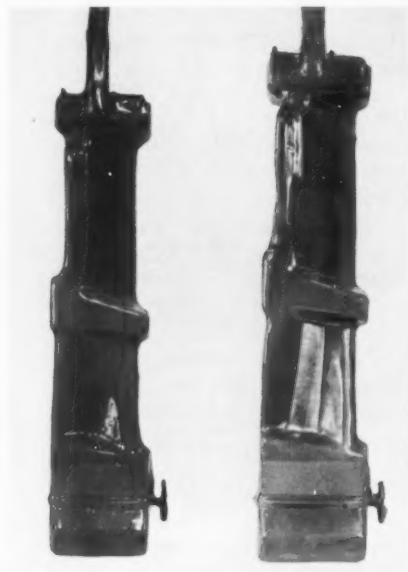


Fig. 7—(Left) Completed coating. (Right) First cut which was processed about one hour.

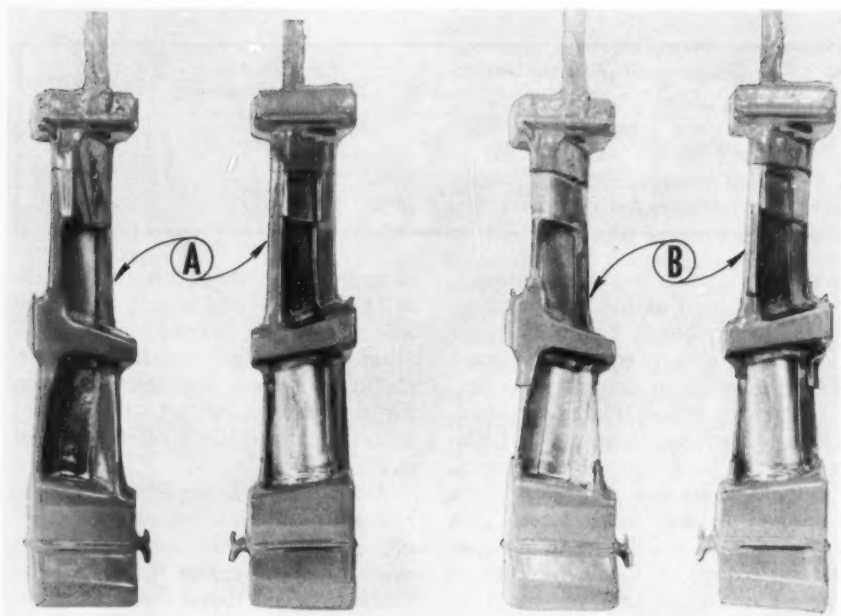


Fig. 8—View (A) shows the second step and view (B) shows the third step of the process.

general procedure of electro-chemical machining was as follows:

Certain areas were given a prime coat to insure good bond of the plastisol (see Figure 6). Parts were placed in the electrical contact clip, heated to 375 deg. F., dipped in the liquid plastisol, allowed to drain, and then cured at 375 deg. F. for 30 minutes. Figure 7 shows the completed coating. The deepest pocket area has the slowest stock removal rate, being a low current density area, so it was exposed first. Figure 7 also shows the first cut, which was processed approximately one hour. The average current density used during all processing was 2 amperes per square inch.

Following the Indi-probe report we progressively stripped the plasti-

sol so that various areas were exposed for times appropriate to the amount of stock to be removed. Figure 8 shows the second step and the third step.

When the third step is reached additional baffling and shielding of the part became necessary to prevent too rapid attack of the edges and undercutting of the masking. Figure 9 shows the baffle plates, clips, and racks used. Figure 10 shows the baffles and shielding strips in place. These baffles and shielding strips force the current to follow a longer path against increased resistance and thereby minimize the rate of attack on edges and projections. The parts were then placed in the tank for the final cut down cycle of 3.5 hours. Figure 11 shows the final results. An

Table I

	Without Electro-Chemical Machining	After Electro-Chemical Machining	Saving
Machining Time	14 hours	6 hours	8 hours
Tool Cost	\$40	\$25	\$15

average of 70 mils has been removed.

As mentioned earlier, temperature control is important. Figure 12 shows the rough pitted results obtained when the solution becomes too hot.

By proper scheduling of the operations of racking, stripping and machining the tank was seldom empty. Twelve airfoils per 16 hours were processed in our small tank. This seems to be a small rate of processing but a look at the breakdown in Table I will show that even the jury-rigged, pick-up equipment we used was capable of considerable savings.

After deducting the cost of electro-chemical machining the net savings was \$70 per part. Since the

program was expanded from 40 parts to 140 parts a total saving of \$9,800 was realized on the machining operation. After the variation of the forging envelope was discovered on the first few parts not one bucket was scrapped in electro-chemical machining.

An additional small saving was realized by electropolishing the original forging for 15 minutes before machining the center section of the bucket. It was found that this slight etching of the "as forged" surface more than doubled the tool life.

Since this time we have done limited additional work on solutions. One, a 1 to 4 mixture of nitric acid

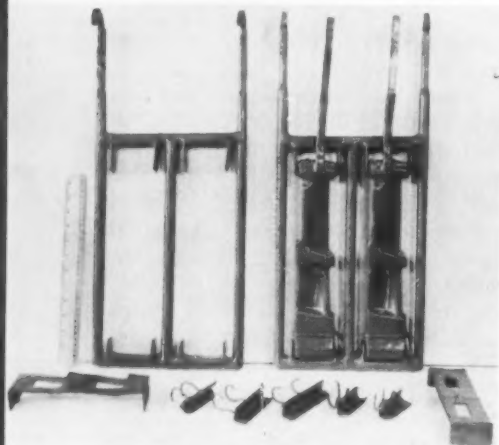


Fig. 9—View showing baffle plates, clips and racks used for electro-chemical machining.

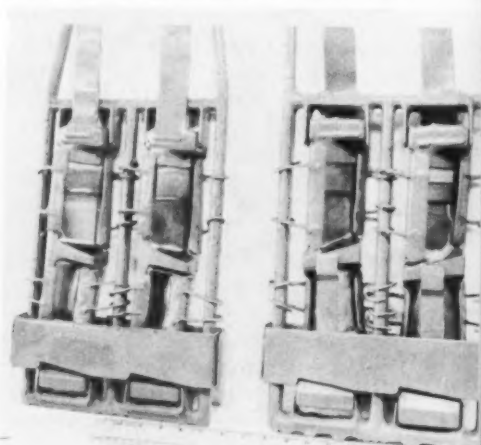


Fig. 10—View shows baffles and shielding strips in place for machining process.



Fig. 11—This illustration shows final results. Average of 70 mils has been removed.

and alcohol has almost doubled the speed (35 mils per hour) of the present 50 percent nitric acid-water solution. The temperature of this solution must be rigidly controlled to 100 deg. F. or less or as has been stated, it has a tendency to "take off". The solution while standing idle, must be protected from evaporation of the alcohol. If the nitric acid content becomes too high, spontaneous decomposition will start and proceed at an ever increasing rate. We have investigated the electro-chemical machining of a A-286 alloy, similar to the 300 series stainless steels. Here, again, the 50 percent nitric acid solution had the higher rate of removal of 16 mils per hour.

It is realized, of course, that General Electric and other companies have developed electro-chemical

machining to produce precise results. These systems require some high priced precision feeding mechanism, high speed pumps, and high power current sources. These systems can sometimes produce parts that are not possible to manufacture by any other method or results in large savings on some parts. Usually, however, a great number of parts are needed to amortize the cost of equipment.

However, for the small operator (or large operator with a small number of special parts) faced with machining some of the more difficult alloys, a simple roughing operation by electro-chemical means could well relieve a bottleneck in production.

Considerable credit should be given to E. Farmer for working out many of the details of the processing assisted by C. Haymeyer. Excellent liaison work by D. Cochran, Manufacturing Engineering, between Chemical Processing, Inspection and Machine Shop materially aided in the unusual success of the program.

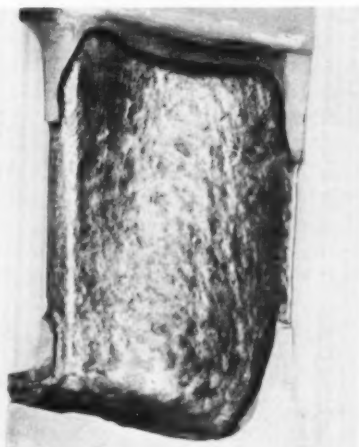


Fig. 12—Illustration showing rough pitted results obtained when solution is too hot.

What's the Job of a Numerical Control Programmer?

Here the author explains the role of the most important individual in any application of numerical control.

By HARRY ANKENY

Manager, Electrical Engineering,
Giddings and Lewis Machine Tool Company

Of all the people who could rightly be held responsible for the success of a numerically controlled operation, the programmer is the most important link in the chain from the designer to the finished part. He must be a combination of methods engineer, tool engineer, and machine operator. It is difficult to imagine all the decisions made by a machine operator until you have tried to set them down in writing a program. He must decide the sequence in which operations must be performed, the type of operation, the tooling to be used, the optimum feed and speed, plus auxiliary functions like coolant. Recognizing the complexity of this job, most systems designers have gone to extra pains to make the programmer's job easier. This may add a few dollars to the first cost of the control, but the savings in programming are gained with every piece.

A programmer who understands and uses all the features provided in a control is necessary to an efficient and economical installation. The simple two-axis positioning control is

a big help in reducing operator error, fixture cost, and manufacturing time; but it is only when a programmer can control all axes and auxiliary functions the way an operator does that the biggest payoff can be achieved. The control should have machining modes that permit fast, heavy cuts for roughing and fine, precision cuts for finishing. It should be possible to call for boring, drilling, tapping, and other cyclical operations by an auxiliary function. Feed rates, speeds, and even the tool should be programmable to enable numerical control to deliver its full potential.

The programmer starts with a drawing of the part to be manufactured and a manuscript that looks something like Figure 1, on which he will enter the machine and operator commands. Now this may look complicated, but to keep the programmer's confusion to a minimum, Electronic Industries Association has a committee working on a standard that will make all manuscripts as similar as possible. The sequence of the columns and the code numbers

used in the columns are all dictated. It may be two years before this standard is issued, but many of the principles are already worked out and I want to refer to them.

A combination of "Tab Sequential and Word Address" formats is called for by this standard. Tab sequential derives its name from the fact that a "tab" code is inserted at the start of each work, and a fixed data sequence is assigned for all commands. If any data is repetitious or not required, only the "tab" character need be punched in that word. The tape is made at the same time the operator's manuscript is typed. The typewriter is set up to print each word of the command in its assigned column. The tab key moves the carriage over to the next column before each word is typed. After the last needed word of any command, the carriage return key is pressed which

causes the "End of Block" character to be punched in the tape. In the control, tab characters are usually used to step a distributor which routes each word into the memory section designed for it.

Word address might more appropriately be called "Letter Address" because a different letter is used before each type of word. The control uses this letter to select which memory section to route a word into. The words may be given in any sequence, but a faster read-in time will usually be achieved with a given sequence. When this control tape is used to run a typewriter, the words do not align themselves in columns and the copy is more difficult to interpret. The operator's manuscript must be prepared separately.

With the combination format called for by the standards, a fixed data sequence is specified for all

[illegible]

Figure 1—Manuscript for machine and operator commands (G & L 65-H5-T Machine).

"All manuscripts must have this sequence number."

commands, and each word will contain a tab character and a letter. The tab characters used will align the manuscript, but these tab characters may be ignored by the control if it is decided to route the words on a word address basis. Likewise, the letter characters can be ignored if it is decided to use the tabs to route the words to their appropriate memory sections.

Starting in the left-hand column of Figure 1, the sequence number is a three-digit number to allow for reference to any particular line or block of information. Each block constitutes a machine command. Some controls display this sequence number to help the operator follow the manuscript with regard to any instructions written in the right-hand column. All manuscripts must have this sequence number.

The next column is for Preparatory Functions. These are code numbers used to set up the control for various modes of operation such as drilling or tapping. Sometimes they are used to indicate plane selection or feed direction. This is the feature

that allows the programmer to make a machine under tape control as valuable as a manual machine with the most skillful operator.

The next columns are used to set down dimensional information for however many axes are being controlled. These may or may not be preceded by a plus or minus sign and may consist of different numbers of digits. Even those with the same number of digits may differ because the position of the decimal point may be different. The period or decimal point should not be coded in the tape, though most controls will ignore it.

Following the dimensional columns are those applying to feed rates and speed. In these will be code numbers which will indicate the desired feed in inches per minute or inches per revolution and speed in revolutions per minute.

The EIA committee has worked out a three-digit code that can cover numbers from .0001 to 99,500. The second and third digit of this coded number are the feed or speed rounded to five digit accuracy. The first digit of the coded number has a value three greater than the number of digits to the left of the decimal point of the feed or speed. If there are no digits to the left of the decimal point, then the number of zeros immediately to the right of the decimal point is subtracted from three to provide the value of the first digit.

For example, 1728 is coded as 717; 7.82 is coded as 478; and .00876 is coded as 188. With a little practice, this code can be read directly. We hope control builders will ar-



Figure 2—Tape preparation equipment—a typewriter, a tape punch and a tape reader.

range to accept these codes and cause the machine to provide the nearest possible feed or speed.

The column for Tool Function will have a code number for the tool to be selected in tool changing machines, or the number may be displayed to signal the operator which tool to put in the spindle.

Miscellaneous Functions are code numbers used to turn on the coolant, start the spindle, clamp the table, and so on. An attempt is being made to standardize these numbers so they will mean the same thing to all controls.

In the last column is typed any information which the operator may need. On machines where the third axis is not controlled, this may tell him the depth of cut. If tools are not coded, this may tell him the tool to be used. Whatever the instruction, this is not coded in the machine control tape. The machine operator should receive a copy of the manuscript when he gets the job, and he should use the sequence number to correlate his instructions with the operation to be performed.

After the programmer has written down all the machine and operator commands necessary to make the part, he turns the manuscript over to a typist to prepare the media used to control the machine.

In its usual form the tape preparation equipment consists of a typewriter, a tape punch, and tape reader combined into one unit, Figure 2. As keys are pressed, the manuscript is printed on paper and the hole patterns are punched in the tape. With this equipment, a tape can be read and a new manuscript typed automatically. Also, a tape can be read, a manuscript typed, and a new

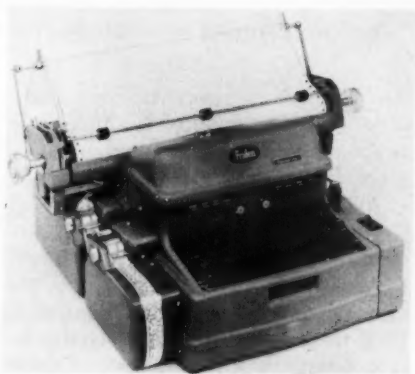


Figure 3—A verifier such as this insures error-free tapes to the greatest degree possible.

tape punched simultaneously. This last method is used when it is desired to change or correct a tape. The old tape is copied automatically down to the point where the change or correction is to be made. Then the new data is inserted by using the keyboard. After hand feeding the old tape past the portion being changed, the tape reader is restarted to continue the automatic punching.

To insure error-free tapes to the greatest possible degree, a verifier, Figure 3, should be used. The original tape is inserted in the motorized tape reader to the right, and the manuscript is again typed on the typewriter. As each character is keyboarded, its assigned code is compared with the code in the original tape in the motorized tape reader. If the two codes compare, the typewriter punch will operate and punch the verified code in the new tape. If the two codes do not compare, the typewriter punch will not operate and the keyboard will lock. The operator must then determine whether the error is in the original tape or her present typing. She then presses

"Most positioning controls operate on absolute dimensions."

the "error reset" switch on the front panel of the typewriter to unlock the keyboard and types the correct character. The correct code is punched in the second or verified tape.

Nearly all systems being designed today use an 8-channel, 1-inch-wide punched tape with the Flexowriter NC-1 code, Figure 4. This weighs the first four channels, 1, 2, 4, and 8. All numbers are made up as binary coded decimals from combinations of these numbers. The other four channels are Parity, Zero, X and End of Block or Carriage Return. Letters are made up from number combinations plus Zero or X or Zero and X. Besides numbers and letters, the principal codes used are plus, minus, period (decimal point), space, tab, and carriage return. Obviously, space, tab and car-

riage return do not make a mark on the manuscript.

The parity channel is used to make every row have an odd number of holes. If the code would otherwise result in an even number of holes, an extra one is thrown into the parity channel. On reading, the control checks the quantity of holes so that if it should miss one an even number would be read and an error would be indicated.

This is not the most efficient use of the holes available, but it does achieve a great deal of compatibility and interchangeability. I feel it is a big step forward from the many tape widths, special codes, and hand punching that prevailed not many years ago. Issuance of EIA standard RS-227 on dimensions of the tape meant users could not purchase a fairly expensive piece of tape preparation equipment with the assurance that they could use it to make tape for any control by specifying this EIA standard on their purchase order. Very shortly, EIA standards proposal 621 on tape code will be issued; then the user will be protected further.

Most positioning controls operate on absolute dimensions. That is, all points are specified in terms of their distances from reference planes. The intersection of these reference planes is called the reference point.

Some controls have a fixed reference point which is usually out of the work area. Some permit various amounts of movement of the reference point to accommodate setup of workpieces, but moving this point into the work area reduces the total

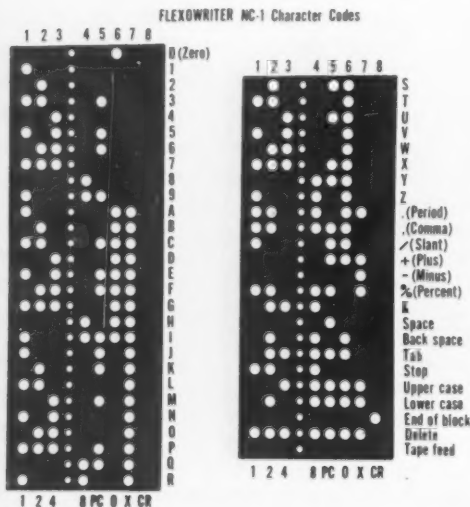


Figure 4—Eight-channel, 1-inch-wide tape.

usable area. Other controls are arranged to set the reference point anywhere to permit programming in accordance with drawing dimensions.

Figure 5 is typical of the type of drawing that requires the ability to set the reference point on the work-piece for maximum programming convenience. This means plus and minus programming to call for the position of points in the four quadrants surrounding the reference point.

If bolt circle drilling, Figure 6, is to be done on a machine that moves only in Cartesian coordinates, it is most convenient to set the reference in the center of the circle. The programmer uses a table of fractions which, when multiplied by the bolt circle radius, will give the X and Y coordinates of the holes.

For controls without reference offset or only a limited range, the drawings should be arranged, Figure 7, with references on the work edge and located with regard to the way the piece will be set up on the machine. This may require the programmer to add a fixed distance to each dimension shown on the drawing in order to obtain the programmed dimension.

Reference offset can be provided as a hand-cranked function, or with a slewing motor for gross movements and a dial for fine movements, or as a completely automatic servoed function.

Computers have not been used to any extent in programming positioning control. No difficult formulas are involved, as most of the coordinates are taken directly off the engineering drawing. Some people with bolt circle work to do have found computers handy for getting coordinates when

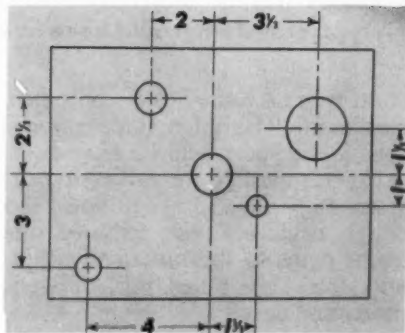


Figure 5—Drawing requiring reference point on work for top programming convenience.

the drawing only says, "36 equally spaced holes on a 32-inch-diameter circle." If someone had a drawing in polar coordinates which they wished to change to Cartesian coordinates, a computer might be feasible. The people who have used computers are those who already had one handy, along with a computer programming staff. Even they do not use enough time to justify the computer for this job alone.

One place where it has been suggested that computers would come in handy would be to convert programs for various machine tools. Under this plan, the programmer would write a standardized manuscript with no regard for the machine tool on which the work was going to be performed. A computer input tape would be punched from this manuscript. With the computer programmed for the machine on which the work was to be done, this input tape would be fed to it, and out would come a tape with all the special features required by the machine's control.

Each machine builder offers certain exclusive features; and, of course, he wants to take advantage

"A typical system would have five resolvers . . ."

of them in his numerically controlled version too. The different inner workings of similar machines have been partly responsible for different programming rules. In addition, the design engineers have followed different paths to the same end result, and this has called for different programming.

At the exposition in Chicago last fall, I counted 24 numerical control systems on display. The necessity for integrating the control with the machine to produce a unitized manufacturing system has led to this individualism. Looking forward to the time when some shops will have several systems, this use of a computer to simplify programming and improve interchangeability of work between machines may be quite practical.

The degree of interchangeability will depend on the conformity of the machines with respect to function, capacity, range, horsepower, geometric relationship of their axes, preparatory, miscellaneous, and tooling

functions. By machine function, we mean you cannot do grinding work on a lathe. By capacity, range, and horsepower, we mean the machines on which work is to be interchanged must be big enough in size and in power. By functions, we mean the controls must be able to put either machine through the same drilling cycle; for instance, they must be able to turn on and off the coolant in each, and they might have to be able to change the tools in each machine.

Various controls work over different lengths and with different resolutions. A typical system would have five resolvers geared so that one revolution of each presented 0.1, 1, 10, 100, and 1000 inches of movement. The coarse resolver must turn less than one revolution for the full travel of the machine, and it is most convenient to program if it turns less than half a revolution for the full travel. This resolver train would be usable with a machine where the maximum travel was about 456 inches or 38 feet. On the other end of the scale, the fine resolver, which turns one revolution for each 0.1 inch of movement, may be used with a control which breaks its data down into 1000 parts. The least programmable increment would be 0.0001 inch, and this is called the system resolution. The dimensional data would be programmed with three digits to the left of the decimal point and four digits to the right of the decimal point.

The system resolution is related to positional accuracy. If less accuracy is acceptable the resolution may be decreased. If the machine travels

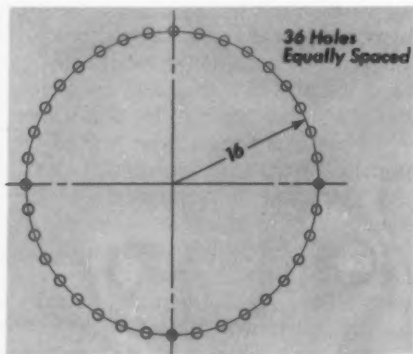


Figure 6—Bolt circle drilling operation makes use of plus and minus programming.

are short, the number of digits programmed to the left of the decimal point may decrease. You can see that the result will be various numbers of digits to be programmed and various locations of the decimal point, even when the number of digits remains the same. Interchangeability is only possible between controls arranged for the same number of digits before and after the decimal point, but we have found that most machines on which work can be done interchangeably do have interchangeable dimensions.

The presence or absence of algebraic signs in connection with the positional dimensions is also a must for interchangeability of tapes. You can see that if you tried to use a tape for a machine which can be programmed plus and minus from the reference point in a machine which only worked in the plus-plus quadrant, chaos would be the result. Likewise, the number of axes under numerical control in the two machines and the nomenclature of the axes must be the same for tapes to be interchangeable.

In programming rotary motions, there seems to be divided opinion on whether we should use decimal degrees or decimal circles. The only thing most control people agree on is that they do not want to program in terms of degrees, minutes and seconds. Decimal-circle programming gives numbers less than one. The decimal-circle proponents point out that a given number of digits will break the circle down into smaller bits; the table will always rotate the shortest way to its next location; and continuing revolutions will not get the position out of step.

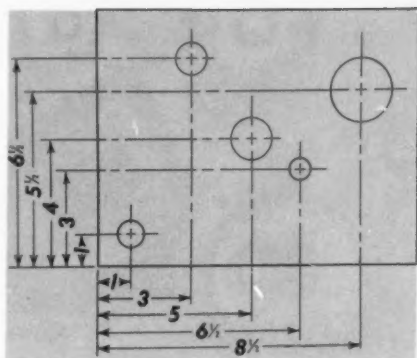


Figure 7—Drawing arranged for controls without reference point or limited range only.

The decimal-degree proponents argue that people think in terms of degrees. Therefore, if the drawing called for 46.800 degrees, the programmer and shopman would know about what was wanted while .1300 circles might not mean anything to them.

In summary, we should remember that the programmer is the most important link in the chain from the designer to the finished part. He should be as knowledgeable as possible in the area of machining practices and methods. His job should be made as easy as possible, and every available feature to get the most out of the machine should be put at his disposal. Standards to reduce the variations in programming from machine to machine are being developed. Computers are not a necessity in programming positioning and straight-cut machines. We are over the threshold into the numerical machining era—let no one hold you back.

The foregoing article is from a paper which was prepared for presentation at the recently held Westinghouse Machine Tool Forum.



View of Nortronics cleanroom. Note coolant supply and return pipes mounted along wall. Rebuilt grinders at left rear can hold tolerance of 25 millionths inch on 4-inch diameter.

Machining Missile Parts to Tolerances of 25 Millionths

***Environmental-controlled cleanroom is specially
equipped for super-precision machine operations.***

By GILBERT C. CLOSE
Field Editor, Modern Machine Shop

In a new environmental-controlled cleanroom, specifically designed, built and equipped for super-precision machine operations

at the Nortronics Division of Northrop Corporation, Anaheim, California, tolerances down to 25 millionths of an inch on parts up to 4 inches in

diameter are being consistently maintained. This is made possible by machines re-worked to greater precision than when new, by a cleanroom temperature of 68 deg. F. plus-or-minus $\frac{1}{2}$ deg. F., by a coolant supply held within these same narrow temperature limits, by room humidity maintained between 35 and 45 percent, and by air cleanliness wherein the dust particle count is not allowed to exceed 50,000 particles per cubic foot. If this later figure seems rather large, compare it with the average home living room where dust particle count ranges between $4\frac{1}{2}$ and $5\frac{1}{2}$ million particles per cubic foot.

When Nortronics received a contract to produce machined parts for the "Skybolt" missile program, it was

immediately evident that the consistent low tolerances required could not be obtained under conventional machine shop conditions. A variation of but a few degrees in temperature of either the room air or the coolant supply being used would expand or contract a part sufficiently to exceed the tolerance limits. Expansion caused by absorption of excessive humidity by some parts, or the amount of surface oxidation it would cause on others, would have the same effect. A speck of dust on an interface, or lodged where it would interfere with a measurement or a fit, could cause as much trouble as a huge boulder blocking the pathway of an automobile. When you chop a thousandth of an inch into another thousand

Another cleanroom view, showing jig borer installation. Each large machine has its own $\frac{1}{2}$ -gallon coolant return reservoir. Work benches are all-metal to reduce dust hazards.



"No 'blow-off' air hoses are used . . ."

parts, then use one of these segments as a basis of comparison, the preceding analogy becomes very logical!

The Nortronics Plant Engineering Department was called upon to erect and equip a new cleanroom that would meet the above specification requirements. Several machines (jig borers and grinders) were returned to the original manufacturer for re-work and the installation of super-precision bearings wherever necessary. Overall machine alignments were corrected to within 0.0001 inch.

The room itself, very much like a cocoon within the main plant building, is 30 feet by 40 feet in size, and

entirely closed off and sealed by insulated panels. Vinyl plastic paint is used on all interior walls to provide a hard, flat surface which is easy to clean and provides no cracks, recesses, or rough areas where dust can lodge and accumulate. The floor itself is covered with a hard plastic coating for the same reasons. An exterior re-circulating type air conditioning unit controls room temperature and humidity. This unit is equipped with an electrostatic filter system which filters down to 5 microns.

No "blow off" air hoses are used in the room as they would only kick



Final checking must be accomplished by optics or electronic measuring devices. Floor and walls of cleanroom are covered with hard-surfaced plastic coating which is easy to clean.

"Admittance to room is rigidly controlled."

the dirt into the surrounding air. Instead, vacuum pickups are used. Employees in the room wear conventional cleanroom clothing consisting of a cap which completely covers the hair, a knee-length smock, and plastic shoes or shoe coverings. Janitorial supervision is constant and meticulous. Admittance to the room is rigidly controlled.

The greatest deviation of this new cleanroom installation from conventional cleanroom design is the provision for a constant-temperature coolant supply. Components of this coolant system include a one-ton refrigeration unit capable of removing

7500 B.T.U.'s per hour from the coolant solution, a 70-gallon main coolant reservoir, and a main supply pump capable of delivering 15 gallons per minute at a pressure of 5 p.s.i. These three components are located outside the cleanroom area. Inside the room, each of the four super-precision machines using the coolant is equipped with its own return reservoir and pump.

The main reservoir receives the coolant being returned and cools it to the proper temperature. The reservoir pump then forces the coolant through piping installed largely within the cleanroom area. This prevents



Cleanroom itself, coolant supply and all equipment in room are kept at 68 degree plus-or-minus $\frac{1}{2}$ degree F. All parts "soak" in cleanroom for 72 hours before work is performed on them.

"All parts machined are allowed to 'soak' . . ."

any temperature effects on the coolant while in the pipes as room temperature and coolant temperature are the same.

After use at the machines, the coolant passes into the 1/2-gallon return reservoir located just behind each machine. Each of these return reservoirs is equipped with a float-controlled start-stop switch which in turn controls the pump which returns the coolant to the main reservoir at a delivery rate of approximately 3 g.p.m. An appropriate filtering system removes all metal fines carried away in the coolant stream. This system has proved its ability to deliver a clean and constant-temperature coolant supply that never varies from the 68 deg. F. plus-or-minus 1/2 deg. F. requirements. The coolant supply itself is a high-flash kerosene, as water in the coolant would affect cleanroom humidity.

All parts machined in the new cleanroom are moved in and allowed to "soak" for 72 hours at cleanroom temperature before any work is accomplished. This assures that the temperature of the part itself, the air temperature, and the temperature of the coolant supply will be exactly the same. Most of the parts that are being worked at this time are made of either an aluminum or magnesium alloy.

As might be expected, tolerance measurements on the parts are accomplished with optical or electronic measuring devices. Though lapping and hand-finishing is used on some parts, the ability to obtain a 25 millionth-of-an-inch tolerance on machined parts up to four inches in diameter (accomplished on a super-precision grinder), and without subsequent lapping or hand-finishing, is alone indicative of cleanroom value!



Broaching—Tooling and Practice. By Horace E. Linsley. Published by The Industrial Press, 93 Worth St., New York 13, N. Y. 216 pages, 6 by 9 inches; 162 line and halftone illustrations. Cloth binding. Price, \$6.50.

This well-illustrated book brings together a wealth of technical and general information covering the entire field of broaching—internal, external, vertical and horizontal. It describes in detail how each type of broaching machine operates, and the types of work for which each is best suited. Various kinds of broaching

operations such as spline broaching, gear broaching, rotary broaching, straddle broaching, continuous or chain broaching, and horizontal surface broaching are explained. Examples are also given of special and unusual broaching operations. The design of broaching tools is covered in detail and a separate chapter is devoted to broaching fixtures. A chapter on setting up and troubleshooting is also included.

This book will be helpful to those in the metalworking field who have not fully investigated broaching possibilities as a means of reducing pro-

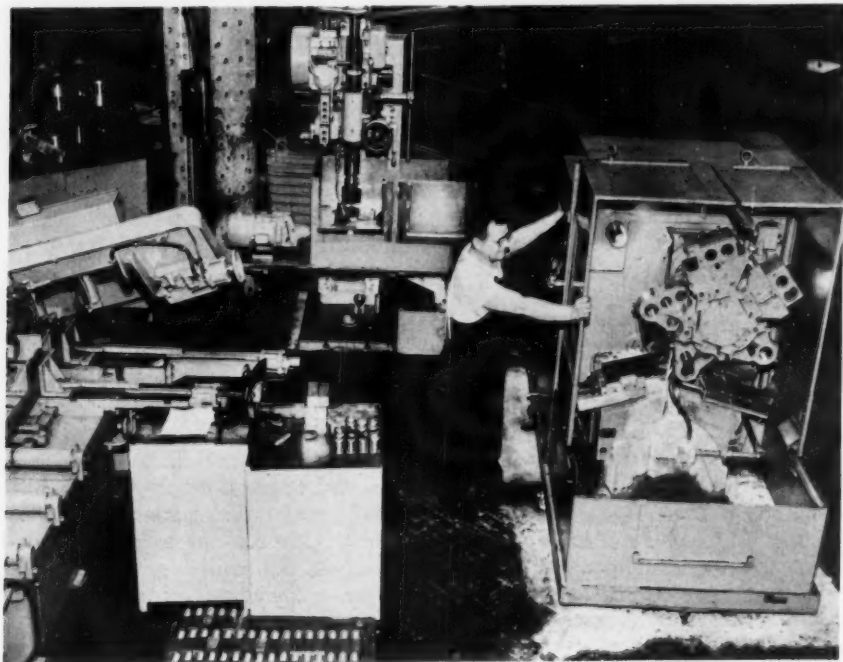
duction costs. Tool and manufacturing engineers will also find the book of considerable interest. It should provide good source material for engineering college and technical institute courses which deal with manufacturing processes, machine tool design, and cost reduction programs.

★ modern machine shop ★

U Layout Machining Center for Bar Stock

A machining center installed at the Locomotive and Car Equipment Department of General Elec-

tric Company, Erie, Pennsylvania, utilizes the "slugging" principle of machining to swiftly convert bar stock into finished machined components in a remarkably smooth flowing, cost saving operation. The machines—automatic bandsaw, single spindle power feed drill press, and a new Warner & Swasey 2AC single spindle automatic chucker—are arranged in a U layout for quick, convenient access by the operator. The bar stock first is cut into suitable length "slugs" on the bandsaw, drilled out where required on the drill press, then moved to the W&S 2AC chucker for complete automatic machining to very close tolerances.



Machining center at the Locomotive and Car Equipment Department of the General Electric Company is arranged in a U layout for quick, convenient access by the operator.

Accounting For TIME



**The author tells how better production control
in many plants is being achieved
with very little additional cost.**

By CARL K. GIERINGER
Cincinnati Time Recorder Company

Management today wants information fast. A few years ago, the lapse of a few days or weeks in compiling production data apparently was not greatly significant. In this decade of the sixties, however, executives not only demand but have a real need for facts on in-plant operations to be received as speedily as their morning newspaper. They need to know how productive time was spent, how much it cost, and such things as where delays and bottlenecks occur, and so on. Failure to receive this information on a day-to-day basis may result in serious profit leaks and almost certain decline in efficiency.

The time clock, long a basic device for securing weekly payroll data, is becoming a more useful tool in obtaining up-to-date information. And its companion, the time card, is being adapted to meet new needs. As a combination, the clock and card are providing a method of securing facts often without a heavy investment in additional office equipment.

In securing the weekly payroll

information, the time clock is the control between "established" department or shop work periods and the actual time worked by employees. The time clock provides the method for obtaining an accurate record for *total* time worked per employee in each pay period. This information is necessary in the accounting for *employee time purchased*. As a standard method, however, the time clock recorded data does not show where the employee's time was spent by *individual operation*. In the language of an accounting department, time spent on individual operations is the *employee's time sold*.

A major evolution is occurring as management demands to know just how and where a employee's time is spent. Such management demands also include reasons as to why material was not available, what caused excessive machine set-up time and other factors relating to efficient operation.

The new demands for more efficient operation are becoming increasingly important in both mass produc-

tion operation and job shops. In the former, it is necessary to know the amount of time spent by an employee on a particular operation as the product "passes along the line." In the latter, management wants to know how employees divide their time on

several operations which often comprise a single job.

When incentive plans are in operation, the established production standard must be compared with the actual time. This procedure provides a method for determining pay pur-

An individual card is prepared each day per employee. This type of system will provide daily posting of labor on Distribution Sheet. It assures accountability of each employee's daily pay record.

DAILY COST CARD

Employee's Clock No. **NO. 541** DATE **7/1** Enter Date

Employee's Name **NAME Herman Jones** Non-Productive Time
The employee must register out when his productive time is interrupted.

Blank time cards are placed in Card Rack mounted adjacent to the Job Time Recorder. This eliminates possible loss or mutilation of card.

Job numbers should be assigned to non-productive time items.

The interruptions could be caused by set-up time down time, waiting time, etc. He then registers in when work is resumed so lost time can be computed.

This type card can be prepared by the Employee. He enters No., Name & Date before proceeding on first job.

Control and Accurate measurement of lost time is a very integral part of your cost system.

Cards are tabulated daily. Job time from this card is posted on labor distribution and job record. Card may be filed by employee number.

Employee registers when Operation is completed.

Employee registers when Operation is started.

JOB NO.	Time	Clock Time Record
	OFF	
	ON	
	OFF	
	ON	
Facsimile Card for 4000 and 1000 Series		
	OFF	
	ON	
	OFF	
	ON	
	OFF	
	ON	
819	OFF	175P 15 50
	ON	175P 14 74
444	OFF	175P 14 74
	ON	175P 13 15
691	OFF	175P 13 15
	ON	175P 12 00
1741	OFF	175P 11 50
	ON	175P 10 75
1001	OFF	175P 10 75
	ON	175P 8 54
614	OFF	175P 8 54
	ON	175P 8 06
171	OFF	175P 8 06
	ON	175P 7 00

Enter Job No.

No. 51230 C Printed by The Cincinnati Time Recorder Co., Cincinnati, O., U.S.A.

Elapsed Time per Operation

Fig. 1—CbM System or "Cost by Man" System.

poses as well as cost analysis of the production of individual parts.

Both attendance time recorders and job time clocks have been developed for these purposes. In all operations, an attendance time recorder

is required for obtaining the data which goes into making up the payroll and meeting requirements of the Wage-Hour Division. In making distribution of payroll costs to unit production costs, the job time clock

[illegible]

Fig. 2—C-b-J System or "Cost by Job" System.

is necessary. From the data derived from a job time clock, an employee's job or individual operation time breakdown may be audited against the total time he spends in his plant or department. This auditing then provides that all time paid for is 100 percent distributed to the proper accounts.

The auditing procedure in the accounting department could actually be compared with the "balancing" practice of a bank. Where a bank balances its accounts to the penny at the end of each day, an industrial payroll department may balance the quantity time to the tenths or hundredths of an hour. In essence, this is balancing the *employee's time purchased* against *employee's time sold*.

New Simplified Systems

Several new systems are now in operation in plants across the country which appear to provide all necessary information for the aforementioned balancing. One is the C b M or Cost by Man method. In this, the daily posting of the employee's time can be distributed or charged to each job on which he has worked.

The method works as follows: A card, as shown in Fig. 1, is issued to the worker. He enters all information on it as indicated. There is no prior card preparation by a clerk or clerical staff. Time ON and OFF for each job is clocked on a job time recorder. Registrations are started at the bottom of the card in order to provide direct subtraction of time.

An individual card per employee, per job, per day is used in this system.

If employee works on five jobs during the day, five cards are used. If the job is not completed at the end of the day, the card is turned in and a new card is issued on the same job the following day.

This provides continuous flow of information to data processing department. Cost of jobs are up-dated at the end of each operation.

Prepared cards may be completed by the tabulating department or prepunched and delivered to the individual work station.

GENERAL ELECTRIC										JET ENGINE DEPARTMENT										LABOR VOUCHER										GT 6614										OPERATION COMPLETE YES NO																																																																					
DATE										BADGE										ST. HOURS										ACCOUNT CHARGED										AREA										LABOR										OVERHEAD										REGISTRATION										ASSY										ITEM										SPLIT									
ENGINE SERIAL NUMBER										PCS ORDERED										PCS COMPLETED										PART NAME										SCHEDULED DATE										HOW ORDERED										WORK DESCRIPTION										ACCOUNT CHARGED										PART OR TOOL NUMBER										LABOR										OVERHEAD									
James Furst										193										2/6										STOP										2 FEB 12.0										START										2 FEB 10.9										HOURS										TENTHS										SHIFT										ELAPSED TIME									
Employee's Name										Badge or Clock No.										Date										Employee Registers when Operation is completed.										Employee Registers when Operation is started.										Elapsed Time																																																											

Fig. 3—CbM/J/D System or "Cost by Man, Job, Day" System.

"Control of all time is most effective . . ."

At the end of the day, the completed C b M card is turned over to the supervisor. Total time on this card must balance for the time indicated on the attendance IN and OUT time recorder card.

All time must be accounted for. This includes waiting time, down time, time allotted to union duties and others. Each job or activity must be assigned a standard number. Control of all time is most effective in flagging supervisory management for action to improve efficiency.

Another system is the C b J or Cost by Job. Here labor time or charge is made against a specific job. A job cost card, as shown in Fig. 2, is made up in advance by the scheduling or production control department. This card identifies the job and may accompany the job through the shop. Each employee who works on the job signs his name or clock number on the card in the space provided together with the time registration ON and OFF the job. This system is applied where it is necessary to have a complete summation of time spent on the job as soon as the job is completed. The completed card allows a study of total time spent on a particular job. Daily posting is not provided since a job may be in the shop longer than a day. This system works best in 100 percent job shops such as automobile or appliance repairing, painting, printing, or general service.

In some applications, the job card can be modified to provide space for identification of the operation to be done on the job. When this is done, the job card becomes a routing card.

Another system is the C b M/J/D system or Cost by Man, per Job or per Day, as illustrated in Fig. 3. In this, a separate card is used by the employee to register his START and STOP time on each different job he works on. Non-productive time is also registered. If the job lasts beyond quitting time, a new card is used the next morning for registering time. This system is applied where mechanical sorting of cards is available. Cards are sorted daily for either labor distribution of employee time or for labor distribution applicable to specific jobs.

This system sometimes requires pre-preparation of cards. It may have the disadvantages attendant with preparation and physical distribution of the cards. However, it is quite flexible and effective in providing control of labor time in production and can be applied to all types of operations. Non-productive time may be entered on a separate job card.

It is also effective when individual incentive payments are made to employees. The job card carries information indicating standard time, number pieces made, number scrapped, standard rate, and incentive rate. From a single card, both the cost of the part and payment due employees may be calculated.

A variation of the foregoing system is the Pa C b M J or Payroll attendance and Cost by Man and Job system, illustrated in Fig. 4. As shown, a perforated daily job ticket is used. As each job is completed, the perforated sections are turned over to a supervisor. This provides a continuous flow of time tickets into the

costing department where labor can be charged against both the employee and the job. The same ticket provides registrations for the IN and OUT attendance payroll time. These are made on the job time clock.

Systems such as we have described

here are being adopted to more and more production operations. They offer you and your management personnel an almost fool-proof method to know how and where an employee's time is spent. One of these systems can work successfully for you.

This card has a dual purpose. The top section contains the total time per employee per day to compute payroll. The perforated sections are completed and removed after each operation. They are forwarded to cost department for posting to job analysis report. The individual Job Ticket can be audited in order to total actual job time reported against attendance time. The top stub is delivered directly to the Payroll Department for daily auditing of attendance time.

Employee's Name		NAME		No.		Employee's Clock No.	
Paul Henry		Paul Henry		177			
Total Overtime Hours	REMARKS	TIME	OUT	IN	OUT	Overtime	
ATTENDANCE							
Total Afternoon Hours		4			17 FEB 17 00	"Out" Evening	
Total Daily Hours	TOTAL	8	4		17 FEB 12 45	"In" From Lunch	
Total Morning Hours					17 FEB 12 00	"Out" To Lunch	
					17 FEB 8 00	"In" Morning	
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
146				17 FEB 17 00			
Pieces	1.05			17 FEB 15 95			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
911				17 FEB 15 95			
Pieces	45			17 FEB 15 50			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
151				17 FEB 15 50			
Pieces	250			17 FEB 13 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
189				17 FEB 12 00			
Pieces	1.10			17 FEB 10 90			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
63				17 FEB 8 00			
Pieces							
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
Paul Henry		177					
OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
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OPERATION		Holding					
Job No.	TIME	IN	OUT				
43				17 FEB 10 90			
Pieces	2.90			17 FEB 8 00			
NAME		No.					
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Job No.	TIME	IN	OUT				
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Pieces	2.90			17 FEB 8 00			
NAME		No.					
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Thanks to the Allegheny Ludlum STEELECTOR

"We simplified tool steel selection immensely when we started using the A-L STEELECTOR System. It slashed our selection time to seconds. And our local warehouse always has the grade and size we need in stock—ready for immediate delivery.

"Here's how we use the STEELECTOR System: We check bar graphs of the STEELECTOR Card for the job at hand (there are cards for hot work, high speed, and tool room grades) to compare the abrasion resistance, toughness, size stability, machinability, and red hardness of the STEELECTOR grades. In seconds we can pick the best combination of properties.

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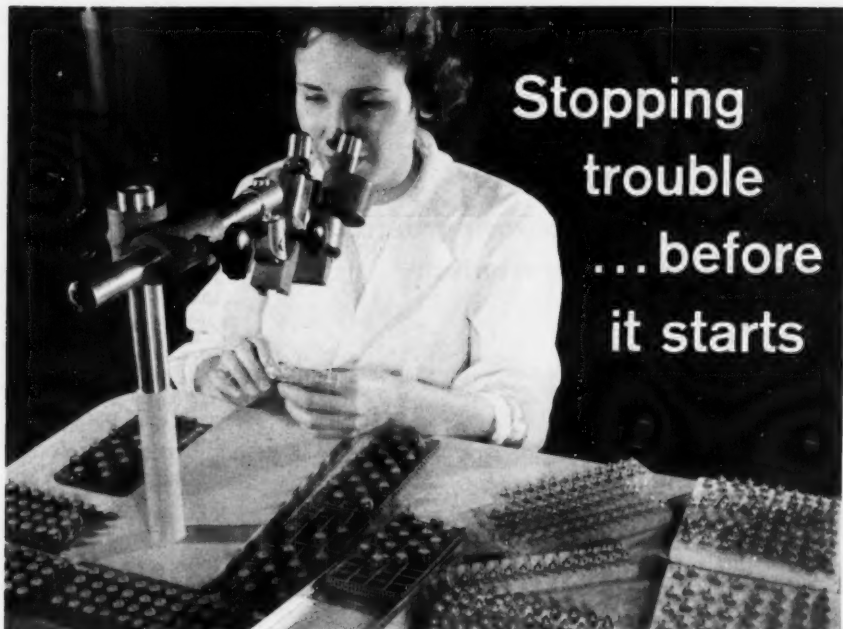
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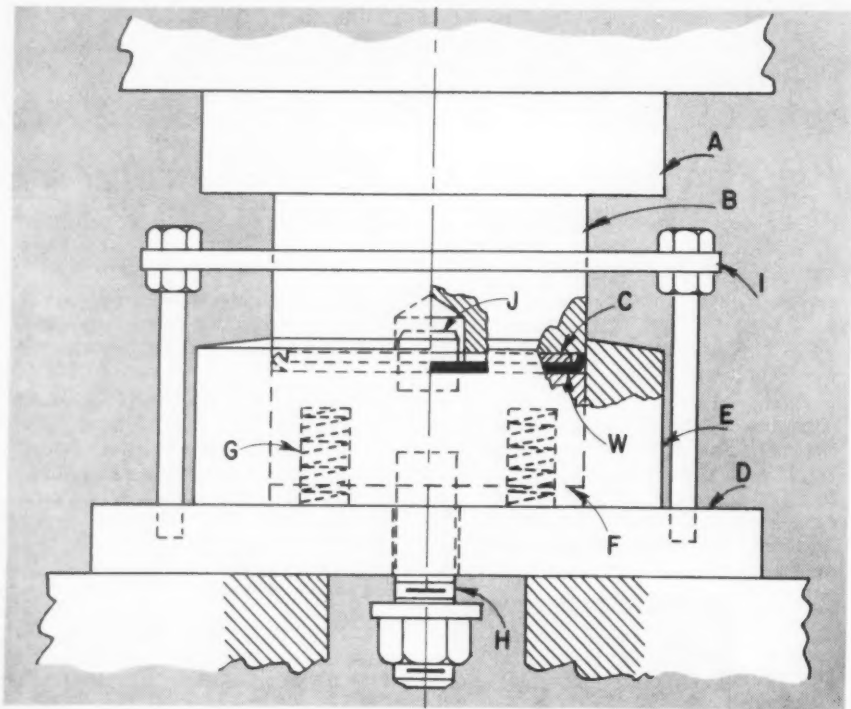
Die Forms Feather-Edged Cup Washer

Construction and operating details of a unique forming die are presented.

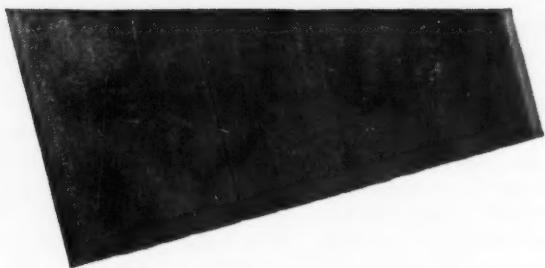
By L. KASPER

The drawing illustrates a die that is designed to form a shallow steel cup washer on which the edges of the cup are feathered to a sharp

edge in the forming operation. This washer is driven into a wooden part which is bolted to a mating wooden part, the purpose being to prevent



Drawing of a die which is designed to form a feather-edged shallow steel cup washer.



the proof is in the cutting



The first cutting stroke of your Nicholson or Black Diamond industrial blade will tell you. Whether you're using a hand hacksaw, power hacksaw or band saw blade, you'll know you're using the finest that modern technology can make.

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Die Forms Washer . . .

wood to wood contact so that easy swiveling of one part on the other is possible.

Referring to the drawing which shows the die assembly on the completion of its downward movement, the plate, *A*, is mounted on the ram of the press and carries the punch, *B*. Spacer plate, *C*, is attached to punch, *B*, in such a way that it can be removed for sharpening, and controls the depth of the cup by its thickness as well as the shape of the corner of the cup by its diameter relative to that of the punch, *B*. The die, *E*, is mounted on the plate, *D*, which is located on the bed of the press. The pressure pad, *F*, loaded with a series of springs, *G*, maintains pressure on the blank during forming and ejects

the finished washer. The upward movement of pad, *F*, is limited by the nut on stud, *H*, so that the pad will hold the blank slightly above the cutting face of die, *E*. Pressure pad, *F*, carries a pin, *J*, which is used for locating the flat blank, and enters a clearance hole in punch, *B*. Any section of the scrap material which may be carried upward on the punch, *B*, is removed by the stripper plate, *I*, and is blown off the die by an air jet. The upper face of die, *E*, is beveled to provide a keen shaving edge. No clearance, angular or radial, is required in the die, *E*.

The edge of the completed washer, *W*, is shown in the cross-sectional view at the right, the flat washer having been formed over the edge of spacer plate, *C*; excess metal is shaved off by upper inner edge of die.



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FROM THE COMPLETE LINE

Handbook of Fluid Dynamics.
By Victor L. Streeter, Editor-in-Chief. 1,240 pages; 6 x 9 inches. Illustrated. McGraw-Hill Handbook Series. Price, \$24.00.

"Handbook of Fluid Dynamics" is an engineering and scientific level handbook—prepared by a panel of experts—broadly covering fluid flow principles, theory, methods, and allied data. Although the coverage is highly practical with specific applications to the fields of hydraulic power, propulsion, aerodynamics, petroleum production, and chemical reaction, theory is included where necessary for a clearer understanding of the underlying principles.

The book is divided into two parts—the first dealing with fundamental concepts and the second devoted to applied fields. There are authorita-

tive discussions of basic equations of fluid flow, laminar flow, flow with chemical reaction, compressible flow, and cavitation. Among the other subjects covered are turbulence, motion of immersed and floating bodies, two-phase flow, flow measurements, sedimentation, and turbomachinery.

More than 30 well-known engineers and scientists—representing a cross-section of industry, government laboratories, and universities—have contributed to the discussions and have presented material on such advances in the field as: fluid power transmission and control; jet and rocket propulsion.

Further information on "Handbook of Fluid Dynamics" may be obtained from the McGraw-Hill Book Information Service, 327 West 41st Street, New York 36, N. Y.

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Drilling Close Tolerance High Finish Holes

Author describes a method which is designed to reduce drill breakage to minimum in drilling tube sheet assemblies.

By C. B. WEIDNER

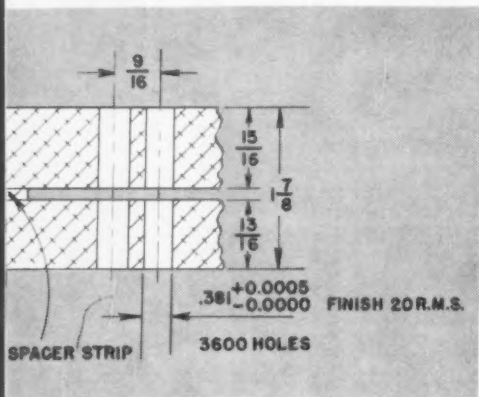
For sheer preponderance of holes, nothing can equal condenser or heat exchanger tube sheets. Couple the amount of holes with constantly tightening specifications on hole quality and you have the makings for a post graduate study in drilling.

Imagine the headaches occasioned by a sandwich made of two 44 inch diameter discs separated by a $\frac{1}{8}$ inch spacer between their faces at

the outer edge. Weld this sandwich into an integral unit by a circumferential weld joining the sheets at the spacer area and drill 3600 holes to meet the specifications shown in Sketch 1. Add the additional specification that the hole in the top sheet and the hole in the bottom sheet must be absolutely concentric to a common center line. The material is 5083 aluminum. The problems to be faced are listed below:

1. Motion of holes in relation to their common centerlines due to the equalizing of stress forces as the tube sheet is weakened by drilling. There can be no stress relieving heat treating operation due to metallurgical specifications.
2. The possibilities of upper tube sheet deflection due to drilling thrust.
3. The extremely high quality finish required on the hole surfaces.
4. Costs, tools and labor must be kept to an absolute minimum.

The problems posed by items 1 and 3 make a two step operation of rough drilling and finish reaming mandatory. The problem posed by item 2 mandated the filling of the



Sketch 1—Sandwich made of two 44-inch diameter discs separated by a $\frac{1}{8}$ -inch spacer between their faces at the outer edge.

"There are no chip clogging problems . . ."

central void. An inlet and vent hole was utilized to fill this cavity with "Cerro-safe". "Cerro-safe" is a low temperature melting alloy which can be melted in boiling water. This low heat has no affect upon metallurgical properties.

The drilling and reaming operation posed no real problem since the operations were to be performed on an automatic pre-programmed positioning hybrid machine the author had designed several years previous. The mechanics of the operation being established, the selection of the tools still remained. The rough drilling was to be performed by a common twist drill. The reaming was to be attempted with a 6 flute right hand spiral reamer with extra-length flutes. The reamer was to have an end-cutting grind with no corner chamfer. The end-cutting grind is required to produce a straight and true hole where the rough drilled hole may have experienced displacement off of a common center line due to differential stress equalizing movements of the tube sheets.

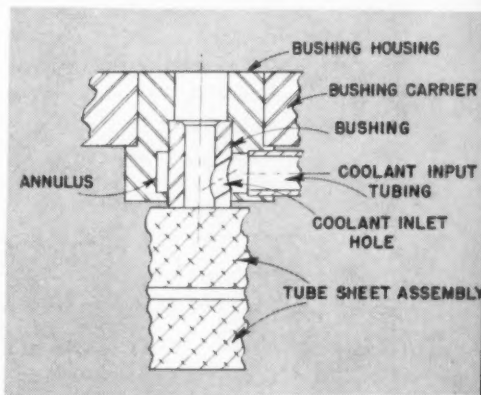
NOTE: Tests made during the actual run of the parts showed that differential motion of holes in relation to a common center line varied from zero to 0.017 inch, depending upon the position in the tube sheet area.

The machine utilized for drilling these pieces is of the tape-controlled automatic positioning type. A specialized bushing is mounted in a bushing carrier, sketch 2. This bushing carrier retracts the bushing about 5/16 inch from the workpiece during the traversing or positioning

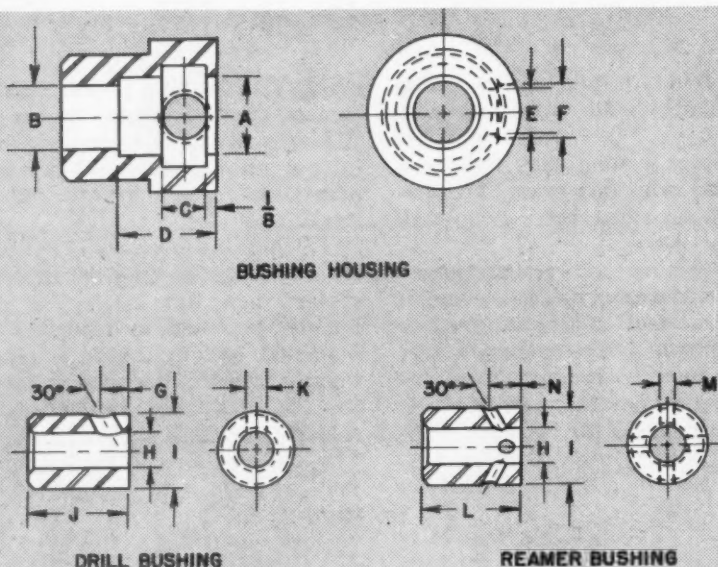
cycle. The bushing is advanced to contact the workpiece during the drilling cycle. The pressure created by the bushing on the workpiece is adjustable from 5 lbs. to 150 lbs. total thrust.

The bushing assembly is composed of a bushing housing which has a coolant input tube connecting to an annulus surrounding a portion of a hardened bushing which is pressed into the center of the housing (sketch 2). The hardened bushing has a coolant inlet hole through one side. This hole connects to the annulus so that a flow path to the bushing bore is open to the coolant flow. This bushing design has permitted a common twist drill to drill holes up to 12.5 diameters in length in a single pass. There are no chip clogging problems and drill cutting edge life per grind is unbelievably high.

Sketch 3 is a breakdown of the component parts. The proportions



Sketch 2—Cross-sectional sketch showing specialized bushing in a bushing carrier which retracts the bushing from workpiece.



A. = "H" \times .375 TO .500

B. = "A" \times .0935 TO .156

C. = I.D. OF COOLANT INLET TUBE = K + 25% MIN.

D. = "H" \times 2.75 TO 3.0 $- \frac{1}{16}$

E. = "C"

F. = "C" + 2 \times WALL THICKNESS OF COOLANT INLET TUBE + .003/.006 FOR BRAZING

G. = "J" / 3 MAX.

H. = DRILL DIA. + STD. BUSHING TOLERANCE

I. = PRESS FIT IN "A"

J. = "H" \times 2.75 TO 3.0

K. = "H" \times .80

L. = "H" \times 2.75 TO 3.0

M. = "H" \times .3 — NO. OF HOLES = NO. OF FLUTES \times .66

N. = "L" / 3 MAX.

ALL OTHER DIMENSIONS TO SUIT

Sketch 3—Breakdown of the component parts comprising the special drill bushing assembly.

"Drilling was done in a single pass."

shown have been proven the best over several years of experimentation on a wide variety of jobs.

The holes were rough drilled with a 5/16-inch diameter H.S.S. taper length drill. The r.p.m. of the drill was 2650, which is about 217 s.f.p.m. The feed per revolution was 0.0094 inch. This produced a total cycle time for drill feed and retract of 5 seconds. Drilling was done in a single pass. The number of holes per grind was 600, a total length of hole of 1125 inches.

No trouble was experienced until the drills were used the second time. A drill broke due to chips welding to the drill and jamming the flutes. There was no advance warning nor any apparent reason for the chips jamming. Two more used drills were broken within the next 100 holes. Additional new drills were pressed into service and the problem of drill breakage ceased.

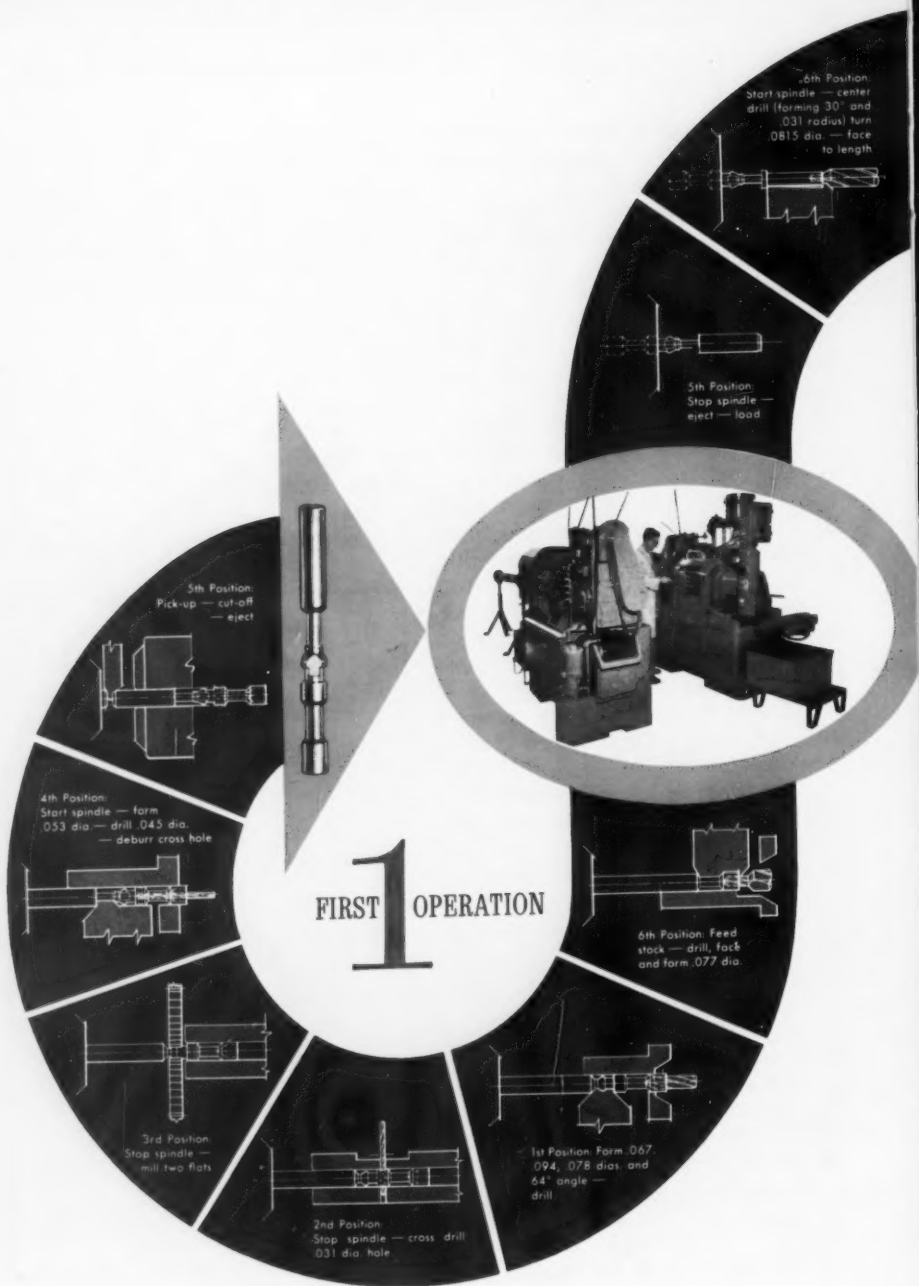
The drills which had been used and resharpened were examined very carefully. The point was checked very precisely and showed no error. A very close examination of the drill flutes showed a very minute area at the root of the flutes which had specks of aluminum welded to the surface. This area was located from 1/2 to 1 inch from the cutting edge along both flutes. One of the used drills was wire brushed to remove the deposits. This drill produced no problems in 600 holes on its second run. This proved to be the cure. The total drill breakage for 48 tube sheet assemblies was 5 drills. Not at all bad for 172,800 holes.

The reamers were also run at 2650

r.p.m. which for a 0.381 inch diameter is 265 s.f.p.m. The feed was reduced to 0.008 inch per revolution. The cycle time for feed and retract was about 6 seconds. Hole finish requirements made it necessary to use an India stone to just break the sharp corner of the outer cutting edge of each flute. Reamers were run 600 holes per grind with no breakage in 172,800 holes. Less than one percent of the holes required touch-up to meet surface specifications. Touch-up was done by rolling.

Coolant used was Socony-Vacuum Cuperol B oil at 200 p.s.i.g. pressure.





1st Position: Drill .0425
dia. hole .261 inches deep

2nd Position: Form
.055 and .0815 dia. —
probe

3rd Position
Stop spindle — mill flat

4th Position
Deburr hole

SECOND OPERATION

ACME-GRIDLEYS REDUCE MACHINE TIME 80% OPERATOR TIME 70%

...FOR SCINTILLA DIVISION
OF THE BENDIX CORPORATION

When it comes to economically turning out large quantities of identical precision parts, most cost-conscious manufacturers rely on Acme-Gridleys. A good example is one of the nation's leading suppliers of electrical connectors to space age industries, Scintilla Division of The Bendix Corporation, Sidney, New York.

Recently, Scintilla converted production of an electrical contact socket and connector to $\frac{3}{16}$ " RA-6 Spindle Acme-Gridleys. Working to tolerances of .002 on turned diameters, .005 on concentricities and 50 microinches or better on drilled holes, the Acme-Gridleys reduced per-piece machine time 80% and operator time 70%! There was also a significant reduction in the reject rate.

Savings like this are the big reason Scintilla has close to *seventy* Acme-Gridleys in their modern production setup. In your plant, Acme-Gridleys will pay off in similar cost reductions... for years to come.

The number of different jobs that can be set up on Acme-Gridleys amazes everyone. To give you some idea, we've described some 57 actual jobs in a new 64-page bulletin called "Circumferential Automation at Work". At your request, we'll be happy to send you a copy. Call, write or wire.



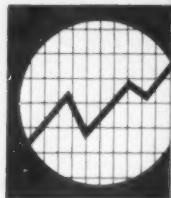
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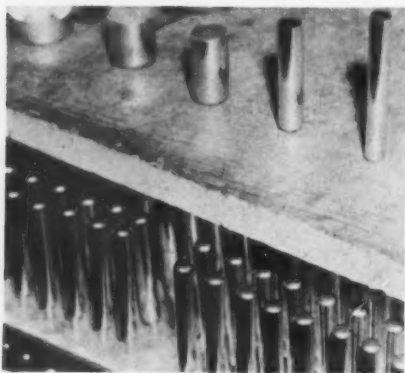
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MORE PRODUCTION



Automatic Press Bank Produces 20,000 Pen Cartridges Per Shift

A bank of seven hydraulic Multipresses and two horizontal Multi-Unit presses are being used at H. E. Morse Co., Holland, Michigan, for deep drawing of ball pen cartridges. Starting with a blank 1 inch in diameter and $\frac{1}{2}$ inch deep, the presses progressively draw a car-



Progressive shapes of the pen cartridge as it is drawn is shown on the top shelf. The lower shelves contain drawn cartridges, awaiting subsequent manufacturing operations.

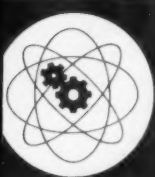
tridge which in its final shape is $3\frac{3}{4}$ inches long, tapering from a $\frac{1}{4}$ inch to a $\frac{1}{16}$ -inch diameter. The metal being worked is a nickel-silver alloy.

The entire operation is automatic, with blanks moving from press to press through air tube and slide feeds. Present production rate is 20,000 units per shift, or 40,000 for a 16-hour day.

The presses are 2 and 3-ton units manufactured by the Denison Engineering Division, American Brake Shoe Co., Columbus, Ohio. Blanks move to the start of the Multipress line on a conveyor from a blanking press. Blanks enter a hopper to the left of Multipress No. 1, and are positioned on the work nest through a slide feed. The work nest then rotates counterclockwise to the ram station, where drawing operations begin. After the ram cycle is completed, the blank is pushed through the bed of the press and is sent to the next press operation through an air tube feed, patented by H. E. Morse Company. This method of drawing and materials handling is common to the first four Multipresses in the firm's production line.

THROUGH

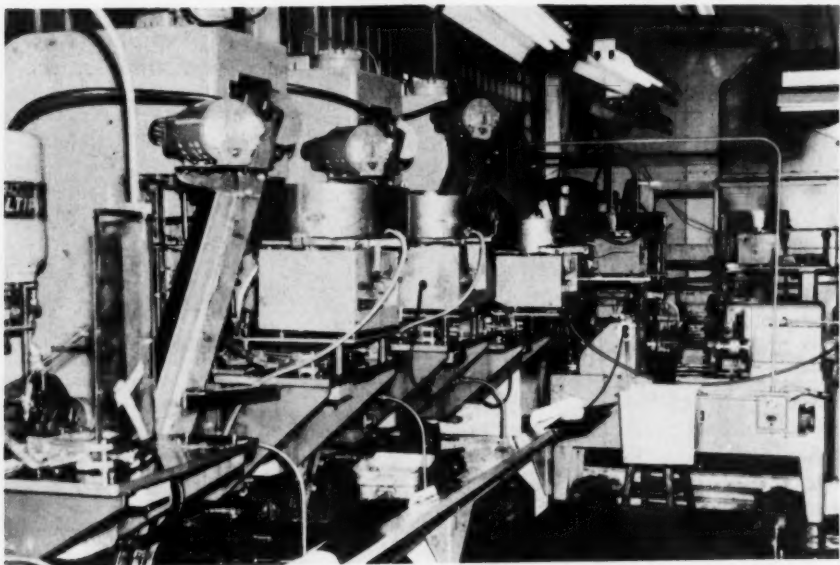
MODERNIZATION



Two horizontal Multi-Unit presses complete the drawing operation. As blanks move from the seventh Multi-press, they are fed to a hopper, which in turn fills a slide feed. This slide feed "loads" the blanks on a six position, rotating head. Tapering dies are

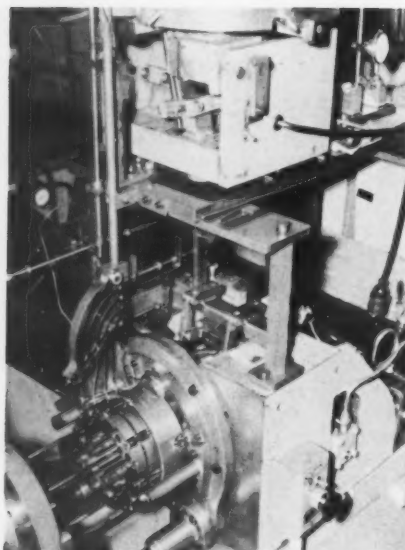
mounted on a horizontally opposed movable head. In operation, the movable head closes with the rotating head in sequence as the rotating head indexes.

Both horizontal presses perform the same operation. They are re-



Overall view of hydraulic press bank which produces 20,000 ball point pen cartridges per shift. At the left are the vertical Multi-presses. In the background are the horizontal Multi-Units.

more production . . .



Close-up of tooling and slide feed arrangement on horizontal press. Cartridges move down from hopper through tube to feed, which loads blanks in rotating head. Tapering dies are on movable head (lower left).

quired to keep up with the production of the seven Multipress bank.

Station six on the horizontal presses is an ejection station. Subsequent manufacturing operations remove the flange, and cut off the tip of the ball point pen cartridge.

A unique feature of the press bank is that each press operates independently. Above each press is an inventory of blanks which are complete to that point in the process. If, for any reason, tooling or press failure occurs, the inventory is cut into the materials handling system, and the line continues to operate while repairs are made.

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Setup Reduces Cost of Machining Aluminum Control Turret

The accompanying illustration shows a close-up of a fast, cost-reducing setup, developed by the DeVlieg Machine Co., Royal Oak, Mich., to machine a preformed aluminum control turret, now used in the entire line of precision horizontal boring machines manufactured by the company. The simplified machining operations involved are a direct result of shifting from steel tubing to extruded aluminum stock in redesigning the control sleeve part and dogs that make up DeVlieg's depth control turret.

Turning of the drum, as shown, is handled on a Jigmil as a boring operation, now a 13-minute job—formerly a 4 to 5-hour operation, as a lathe operation. A combination Microbore tool does the turning, as well as facing and centering required. Only one setup is involved, with the



Fast, cost-reducing setup used by DeVlieg Machine Company to machine preformed aluminum control turret for boring machine.

1. Single Chaser Vers-O-Tool ready for first pass.

2. Single Chaser Vers-O-Tool automatically tripped at end of each pass. Tripping action initiated when machine stop "B" strikes cam slide "A". Operator now returns Single Chaser Vers-O-Tool to starting position "1". Here, it can be reset manually with handle or automatically with machine stop on right side of tool. Only remaining step is index for next pass.

Only NAMCO's Single Chaser Vers-O-Tool
Trips Automatically... Boosts
Short Run Threading Efficiency

Unlike other single point threading tools, NAMCO's Single Chaser Vers-O-Tool backs off automatically at the end of the cutting stroke. For short runs, this means more threading in less time. And, because it just isn't possible to attempt the return stroke while the tool is still at cutting depth, scrappage is eliminated. The tool's multiple cutting edges mean greater threading accuracy and longer tool life while NAMCO's exclusive resharpening method permits quick tool change and precise reset. In short, *nothing* beats NAMCO's Single Chaser Vers-O-Tool for short run threading efficiency. Get complete details on this and all the rest of NAMCO's complete line of Vers-O-Tools. Write today for our 44 page Bulletin DT-60.



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Acme**

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CLEVELAND 9, OHIO

Sales Offices: Newark 2, N. J., Chicago 6, Ill., Detroit 37, Mich.

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work simply being turned on the table after the first end is completely machined. Besides helping hold down the overall price line of the machines, redesigning of the turret assembly in aluminum opens up a new area of flexibility for Jigmil users. The turret assembly, in effect a memory element for depth control of the spindle and rapid traverse, is light enough and low enough in costs that with spares a user can leave the multiple dogs set up, and simply switch drums on the machine.

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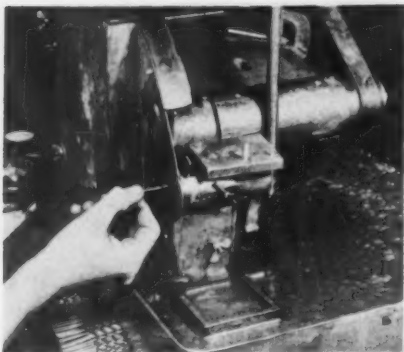
Precision Quills Reduce Twist Drill Manufacturing Costs

In the process of determining how best to make twist drills, Precision Twist Drill Co., Crystal Lake, Ill., producer of a complete

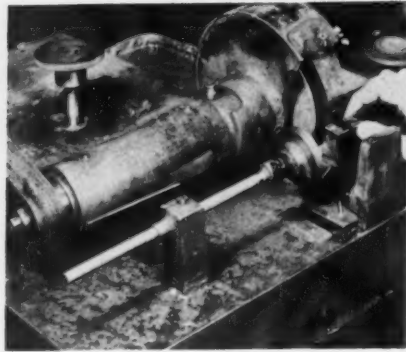
drill line, from 1/5 mm. and up, decided that precision grinding from solid for the smaller drill sizes, using special high speed steel bar stock with special heat treating, would produce the best quality results. By making its own grinding machine, the company also felt they could save equipment investment, too.

To make this machine, the company required a quill, or spindle, of such a design as to have as much precision and accuracy as Precision wanted to put into its drills. This quill, the company specified, must hold to no end play and have long maintenance-free life. After several tests, the Dumore quill, Model 7X-250, made by The Dumore Company, Racine, Wisconsin, was chosen as the best for its purposes.

This Dumore quill, an electric motor with a belt connecting to the quill for power, and a fixture frame were combined to make a bench-mounted special machine setup. First, only one such special machine was made. By using a cut-off blade on the spin-



Relief grinding is accomplished by hand feed through a collet to the grinding wheel. Various size drills are accommodated by merely changing collets and wheels on Dumore quills. Seven machines are used for this work.



Drill blank cut-off operations are usually done on the night shift. Notice the convenient oil cup in plain sight on Dumore quill. Two special machines are used for this purpose. Two other units are used for various other jobs.

with THE BRUSH SURFINDICATOR "meeting specs" is just part of the pay-off...

NEW battery operated MS-1000

Standard 110 Volt BL-110



An Ohio missile-parts maker* knows why. His Surfindicator not only eliminates surface rejects but also cuts machine downtime 60%. Quick, accurate tool checks . . . at his machines . . . insure optimum tool changes to greatly extend productive tool life. *Anyone, anywhere* can measure *any* finish from 1 to 1000 microinches with a compact, portable Surfindicator. Choose the standard model or the ultimate in portability, the new battery powered, completely self-contained, 5½ lb. MS-1000. Ask your nearest Brush distributor for a demonstration. Write for our new booklet . . . 16 pages on how Surfindicator improves profits in five major operating areas . . . production, tooling, engineering, quality control and research.

*name on request

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37TH AND PERKINS

DIVISION OF
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CORPORATION

CLEVELAND 14, OHIO

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June, 1961

MODERN MACHINE SHOP 147

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dle, then a series of special grinding wheels for fluting and relieving. Precision produced a limited quantity of top quality twist drills. Today, Precision Twist Drill has 47 such special machines operating two shifts per day producing top quality drills.

A total of 57 Dumore quills in all are used. In the special machines, 36 are used for flute grinding, two for special slotting and grinding, two for bar stock cut-off operations and seven for relief grinding. Ten quills are on standby for replacement when repairs become necessary.

Precision modifies the standard Dumore quill to facilitate its own manufacturing procedures. Flanges are sweated onto the wheel end of the quills to rigidly hold the various thin grinding blades. Oil cups are added in place of oil eyes to speed location of oiling spots by operators. For more data circle 3 on Postpaid Card

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Electronic Gaging System Solves Transmission Manufacturing Problem

Recently, The Cleveland Instrument Company of Cleveland, Ohio, delivered to one of the nation's leading automotive manufacturers a specially designed electronic gaging system to be used in the manufacture of automatic transmissions and transmission cover plates. This manufacturer had a problem in being required to determine in advance that a given surface would meet the maximum flatness deviation of 0.001 per inch of part length, and the maximum deviation of 0.005 inch from

true flat from end to end, which were the allowable tolerances. In assembly, a paper gasket is sandwiched between the cover plate and transmission case. To be acceptably flat the cover ribs at the meeting face must prevent oil leakage, not only externally to the case, but inter-channel leakage as well. The manufacturer was aware through its quality control department that there was an urgent need for 100 percent piece check. After having tried other methods of accomplishing this end and discovering that the inspection method being used could not keep up with production output demand, (and that the cost of the system was prohibitive), the Cleveland Instrument Company was asked to investigate the problem and was successful in developing the necessary electronic equipment.

With the Cleveland Instrument Company electronic system, after the part is placed in gaging position on the table-like fixture, a simple push on the amplifier start button begins the completely automatic sequencing of 17 gaging impulses. Any deviation from the manufacturer's quality control standards is immediately apparent. The entire gaging sequence is completed in 10 seconds.

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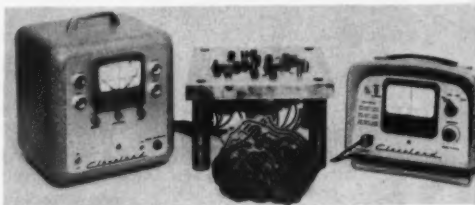


Illustration showing automatic transmission unit and cover and the special electronic gaging equipment employed in inspecting same.



POSITIVE DUPLICATION—EVERY TIME!



Each one of these kernels of corn has positive duplication built into it, just as have these internal wheels, and **all CINCINNATI® GRINDING WHEELS**. There are good reasons for this ® dependability . . . 36 good reasons.

FAMOUS, UNIQUE PROCESS

Three dozen unvarying quality controls govern every step of the famous Cincinnati ® manufacturing process, unique in the industry.

For example, the atmosphere of the mold room is *climate controlled* with conditions of temperature and humidity that *remain the same* from hour to hour, from day to day, from year to year!

RESULT: UNSURPASSED UNIFORMITY

This extraordinary attention to manufacturing detail results in wheels of unsurpassed uniformity. You can reorder CINCINNATI WHEELS with confidence, because

they give you the same good job time after time. You use fewer wheels because ® wheels last longer.

CALL CINCINNATI TODAY

Factory trained by the Cincinnati Milling Machine Company, our grinding specialists are available to you for consultation on all your grinding problems. Call your CINCINNATI GRINDING WHEELS Distributor, or contact us direct, Cincinnati Milling Products Division, Cincinnati 9, Ohio.



POSITIVE DUPLICATION

CINCINNATI®
GRINDING WHEELS

*Trade Mark Reg. U.S. Pat. Off.

A PRODUCTION-PROVED PRODUCT OF THE CINCINNATI MILLING MACHINE CO.

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June, 1961

MODERN MACHINE SHOP 149

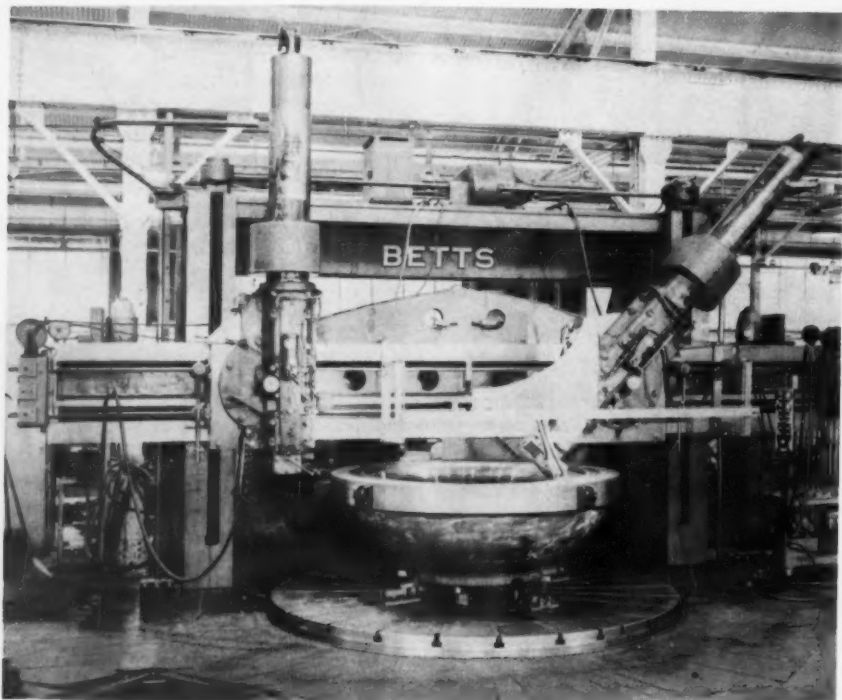
more production . . .

Tracer Machining and Explosive Forming Techniques Combined to Make Missile Reflector

One of the largest explosive formed parts being fabricated at the Ryan Aeronautical Company's Aerospace Division in San Diego, California, is a 78-inch die parabolic missile reflector. The reflector has a 22-inch depth designed

with a tolerance of 0.002 inch for the X and Y coordinates, and is made from 6061 aluminum with final configuration to be aged to the T6 condition.

The problem in fabricating such a reflector was the explosive forming tool. The problem centered around the selection of tooling material and how to machine such a tool but still maintain surface finish and designer's tolerance. Design studies led to the decision that the die would be made of ductile iron, Type 80-60-3 pearlite. Rough calculations indicated that this tool would be machined



Large ductile iron casting is machined to 0.002 inch tolerance by a Mimik hydraulic tracer at National Supply Company. Casting

was prepared as a die for explosive forming a 78 inch parabolic missile reflector at Ryan Aeronautical Company's Aerospace Division.

from what is described as the largest ductile iron casting ever poured in this country. The finished tool weighed approximately 20 tons.

Pouring and machining of the casting into the finished explosive forming tool was accomplished for Ryan's Aerospace Division by the National Supply Company of Los Angeles, California. Machining of the casting was performed on a Betts vertical boring mill using a Mimik hydraulic tracer attachment. The machining of the tool was accomplished within the designer's tolerance of 0.002 inch with a satisfactory surface finish.

The hydraulic tracer attachment, which was manufactured by the Allied Pacific Manufacturing Company, Compton, California, under license from Mimik Tracers, Inc., Buffalo, New York, was guided, during the machining operation, by means of a template that was mounted above the workpiece.

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Expandable, Shell-Type REAMERS feature . . .

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shells that
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For Twist Drills, Reamers, Taps, Counterbores, End Mills, Milling Cutters,
Hobs, Gages, Dies, Carbides (solid or tipped) . . . and for Engineering
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MODERN MACHINE SHOP

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IDEAS FROM READERS



Quick Clamp Simplifies Fixture Design

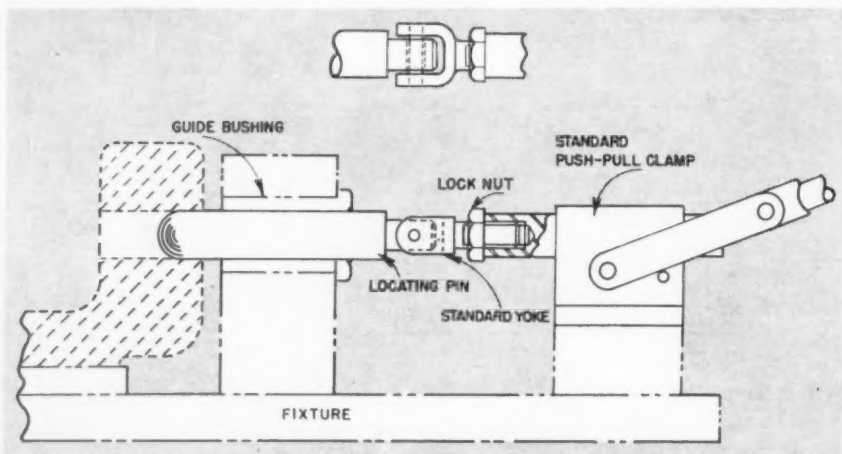
By R. K. DULEK

Fixture design very often calls for the use of disappearing locating pins, index plungers, or a number of other arrangements where a pin has to be advanced and retracted. Many times this proves to be costly and very time-consuming.

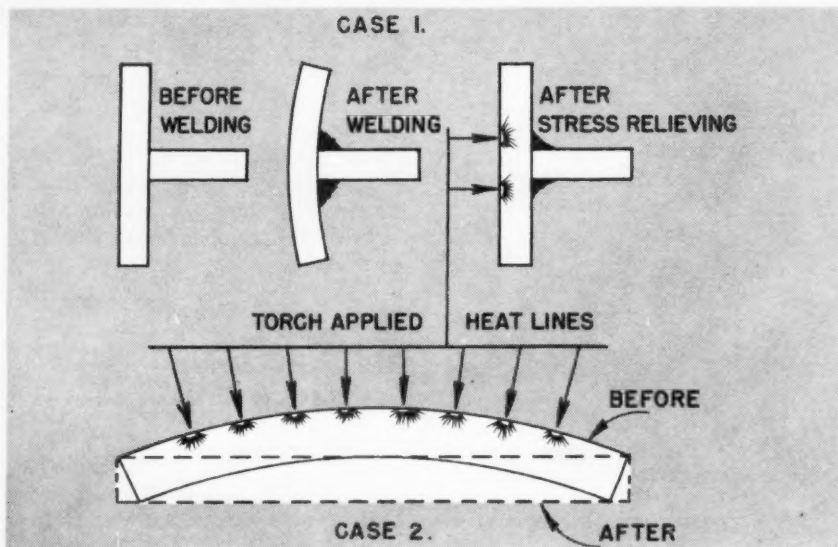
Shown in the accompanying sketch is an inexpensive, positive and sturdy

design of advancing and retracting pin. A standard yoke is fastened to the end of a standard push-pull type quick clamp and the locating pin is then fastened to the yoke. A slightly oversize hole in the pivot end of the locating pin allows the pin to quickly and easily find the center of the guide bushing.

With the versatility of the quick clamp, the unit can be mounted in any desired position and also give the necessary leverage sometimes required to retrieve a snug fitting pin.



Sketch of a fixture incorporating a sturdy design of advancing and retracting pin.



Sketch showing method for relieving welding stresses by application of torch heat.

Relieving Stresses by the Torch Method

By ALFRED A. PECK

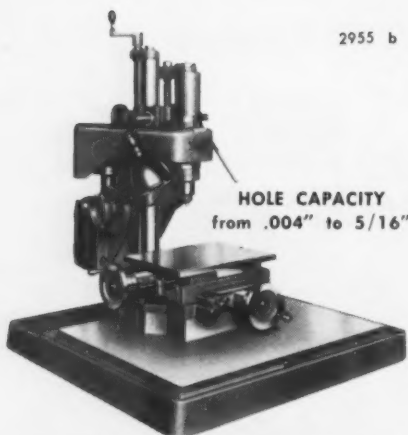
Most steel shafts and other steel components of most any variety, whether cold rolled, hot rolled, weldments, and so on, may be straightened or "deformed" by the mere application of a torch flame on the particular spot of need without also adding external pressure forces to the object. However, the application of heat must always be on the stretched side of the metal, such as a hump, bow, kink, and so on. As long as that portion of the metal is not stretched beyond its rupture limit, the chances are good that it will return to its straight condition by the application of this method. The reason for this is the inherent stability

of the metal and resistance to change under uniform temperature. However, if heat is applied to any one particular spot, thereby inducing an unbalance of stresses and plasticity of the metal, it will deform. This then becomes a useful tool in the correction of deformed material.

The side being heated will naturally expand, thereby tending to make the bend or deformation even greater, but because of the heat, the plasticity of the material is unbalanced. In other words, the hot side is made softer. If the application of heat is used for straightening purposes, it should always be applied on the "hump."

Of course, care should be exercised in the application of the amount and depth of the heat. Normal "spot" heating to a dark red is sufficient and heat blistering should be avoided on

2955 b



PRODUCTION-MINDED *and* **PRECISE**

The NEW Hamilton-Varimatic Super Sensitive Drilling Machine is, by far, the most accurate, most rigid Varimatic we have ever built.

Mechanism, self contained, super sensitive, precise, swings radially on the column and locks at any desired station.

Base is longer, wider, heavier than ever before. Column collar is taller and heavier for more rigid support of working unit. New design of motor mount features extra reinforcing, and this, plus a new electrically and dynamically balanced Machine Tool Motor all but eliminates vibration.

Spindle speeds are infinitely variable. A simple adjustment of the graduated hand wheel selects any desired spindle speed between 840 and 2700 R.P.M., or between 2900 and 9300 R.P.M.

GET THIS!

Bulletin No. 2955 provides complete description, includes sectional drawing, lists features, gives specifications. It's free for the asking. And we'll be glad to have you ask.

**THE HAMILTON TOOL
COMPANY**

**828 SOUTH NINTH STREET
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ideas from readers . . .

finished shafting. An illustration of the usefulness of the method is the forever present problem of heat distortion in arc welding, which then is counteracted by spot or line stress relieving through heating as shown in the accompanying sketch.

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Reduction Drive for Electric Drill

By ROBERT MICALS

A $\frac{1}{4}$ -inch electric drill fitted with a reduction unit made from an old air drill has enough torque to drill a $\frac{1}{2}$ -inch hole through steel. The unit, as shown in the accompanying illustration, was removed from an old air drill and the rotor cut off. An 8-inch steel handle was then welded to the outside case as shown. The original chuck was removed and replaced with a $\frac{1}{2}$ -inch gear chuck.



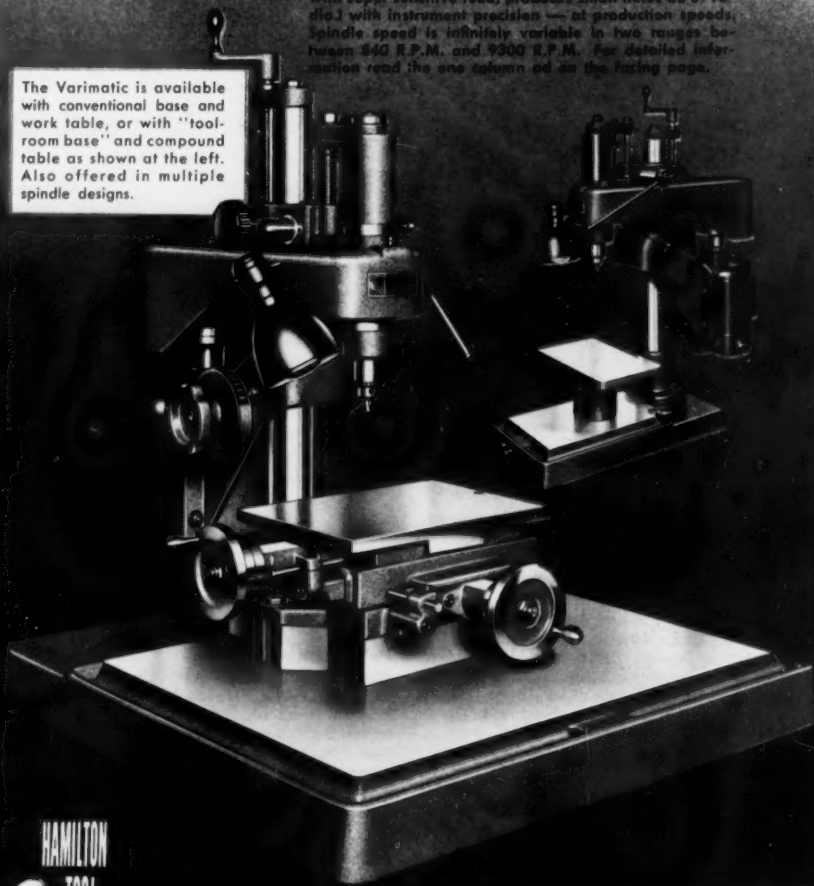
Reduction drive for a $\frac{1}{4}$ -inch portable electric drill which was made from a broken air drill.

June, 1961

PRODUCTION-MINDED *and* PRECISE

The Hamilton-Varimatic, a radial type drilling machine with super sensitive feed, produces small holes (to 5/16" dia.) with instrument precision — at production speeds. Spindle speed is infinitely variable in two ranges between 540 R.P.M. and 9300 R.P.M. For detailed information read the one column ad on the facing page.

The Varimatic is available with conventional base and work table, or with "tool-room base" and compound table as shown at the left. Also offered in multiple spindle designs.



THE HAMILTON TOOL COMPANY

828 SOUTH NINTH STREET

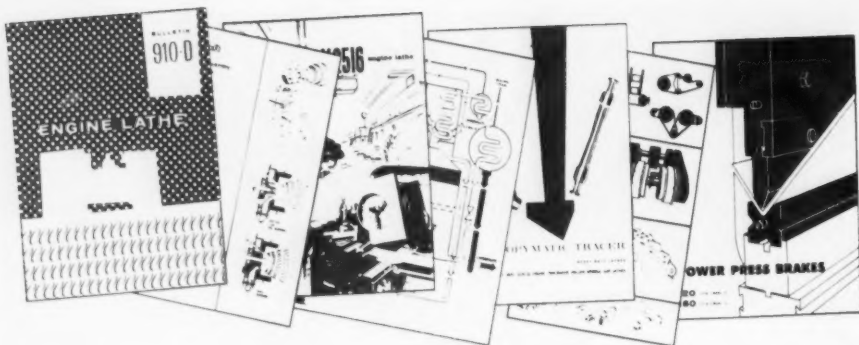
HAMILTON, OHIO

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June, 1961

MODERN MACHINE SHOP

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Use Postpaid Cards opposite Page 32

Engraver

Antares Instruments, Inc., 55-02 37th Ave., Woodside 77, N. Y. Flyer describes and illustrates the 2-dimensional heavy duty Pantograph Engraver Model Gm 11a. It also lists specifications and accessories.

For more data circle 6 on Postpaid Card

Drill Jig Bushings

Accurate Bushing Co., Garwood, N. J. Catalog B-60 gives complete tolerance and dimensional data on all ABC A.S.A. standard bushings. In addition, there is a chart of the decimal equivalents of all the fractional, letter, and number drill sizes.

For more data circle 7 on Postpaid Card

Dry Lubricating Stick

Alpha-Molykote Corp., Stamford, Conn. Typical extreme pressure applications of Molykote Lubricating Sticks are the subject of Bulletin 128. This two page, two color bulletin gives tips for effective application of this product.

For more data circle 8 on Postpaid Card

Numerically Controlled Milling Machine

Giddings & Lewis Machine Tool Co., Fond du Lac, Wis. A 12-page Catalog DM-115 describes numerically controlled horizontal die sinking and contour milling machines. Also listed are operating advantages and cost savings of numerical control and horizontal-spindle design. Catalog also describes machine construction and control features, illustrates optional equipment and includes basic specifications for 10 and 20-h.p. machines.

For more data circle 9 on Postpaid Card

Surface Grinding

American Emery Wheel Works, Providence 1, R. I. An illustrated brochure, in color, outlines complete range of Vertical Spindle Surface Grinding Wheels and Segments. It describes and pictures the various segment shapes, bonds and abrasives available, together with their work applications and advantages.

For more data circle 10 on Postpaid Card

Marking Machines

The Acromark Co., 9 Morrell St., Elizabeth, N. J. Seven pages of illustrations and details concerning nameplates, metal and plastic parts and how they are stamped or otherwise marked, in Acromark marking machines, give a full understanding of marking and the various processes for accomplishing it.

For more data circle 11 on Postpaid Card

Twist Drills

American Twist Drill Co., 14301 West Chicago Blvd., Detroit 28, Mich. Catalog 960 contains illustrations on the complete line of high speed steel, carbide tipped and solid carbide drills for hard steel and special twist drills, together with pages of helpful drill pointing and engineering data. Price list is also included.

For more data circle 12 on Postpaid Card

Tapping Machine

Columbia Tool & Die Works, 716-39th Ave., N. E., Dept. M, Minneapolis 21, Minn. Two page, color bulletin on Anoka Multiple Adjustable Lead Screw Tapping Machine, Model No. 100. The bulletin includes features and specifications.

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FREE LITERATURE

and Inside Back Cover for requesting free copies of literature listed below.

Weldrod

Ampco Metal, Inc., P. O. Box 2004, Milwaukee 1, Wis. A series of reference data charts have information on comparative bronze electrodes, melting rates and efficiencies, electrode and filler rod specifications and recommended welding currents for various welding procedures. Also described are Ampco's weldrod color code, deposit density, number of electrodes per pound and feet per pound of bare rod and wire.

For more data circle 14 on Postpaid Card

Control System

Blue M Electric Co., 138th and Chatham St., Blue Island, Ill. A 6-page, two-color Bulletin No. 7005C, entitled "Blue M's New Controlled Humidity Cabinets," features Power-O-Matic 60 Saturable Reactor Controls, the revolutionary proportional no cycling control system. It also illustrates and describes other chambers and cabinets; cooling units; and water, oil, and refrigerated baths.

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Gap Type Presses

Dake Corp., 612 Robbins Rd., Grand Haven, Mich. Four page color bulletin presents the Dake line of hydraulic straightening and forcing presses. It includes illustrations, features and specifications.

For more data circle 16 on Postpaid Card

Chuck Jaws

Royal Machine & Tool Corp., 31 Deming Road, Berlin, Conn. Bulletin JR361 describes grip-lock custom chuck jaws and special holding devices. Illustrations are also included.

For more data circle 17 on Postpaid Card

Tap Selector

Besly-Welles Corp., 120 Dearborn, South Beloit, Ill. Designed to simplify tap selection for tapping a wide variety of metals, the Besly Color-Keyed Tap Selector presents a newly developed system which uses a revolutionary color code to make tap selection fast and almost automatic.

For more data circle 18 on Postpaid Card

Socket Screws

Bristol Co., Waterbury 20, Conn. A six-page illustrated catalog No. 783 contains information on socket screws with the Nylok self-locking insert. Included is technical data on the properties of the nylon, pellet size and location, and dimensional standards available from stock.

For more data circle 19 on Postpaid Card

Grinder

Bryant Chucking Grinder Co., Springfield, Vt. An illustrated, four-page folder gives complete specifications and details on the Bryant Double-End Internal Grinder. Included are detailed descriptions of machine movements, a schematic close-up of tooling area, and complete operating specifications. This machine is designed for grinding both a straight and a tapered bore at a single chucking.

For more data circle 20 on Postpaid Card

Punch Press

Kenco Mfg. Co., 5211 Telegraph Rd., Los Angeles 22, Calif. Flyer in color describes and illustrates 3 and 5 ton punch presses. Specifications are also included.

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free literature . . .

Overhead Spindles

Cincinnati Milling Machine Co., Cincinnati 9, Ohio. Two publications in color describe two types of Independent Overhead Spindles. The two units perform the same variety of operations differing only in the method of spindle speed selection, hand cranks for the small spindle (publication M-1963-2) and pendant dial selection for the larger spindle (publication M-2034-1). Both publications include illustrations and specifications. For more data circle 22 on Postpaid Card

Coated Abrasives

Carborundum Co., P. O. Box 337, Niagara Falls, New York. This catalog on coated abrasives for the automotive trades is a 20 page listing of discs, sheets, rolls, belts, sleeves, cones, molded discs and accessories used in the repair of auto bodies.

For more data circle 23 on Postpaid Card

Boring Mills

Cincinnati Gilbert Machine Tool Co., 3366 Beekman St., Cincinnati 23, Ohio. Primary features of the new "F" Series Table Type Horizontal Boring Mills are summarized in this illustrated 6-page bulletin. The illustrations show construction details of

3½ and 4 inch machines. Other features are specifications and data on two types of pendant controls, automatic positioning, tracer and numerical controls and accessory equipment.

For more data circle 24 on Postpaid Card

Cut-Off Machine

A. P. deSanno & Son, Inc., Phoenixville, Pa. Flyer describes the Radiac Junior cut-off machine, which is used for reamers, taps, drills, thin walled tubing and solids up to 1½ inches. For more data circle 25 on Postpaid Card

Motion Detector

Danly Machine Specialties, Inc., 2100 South Laramie Ave., Chicago 50, Ill. Bulletin No. 45 describes the Motion Detector, which will monitor shaft rotation and detect other stoppage or slow-down of a shaft. Its four pages also contain illustrations and specifications.

For more data circle 26 on Postpaid Card

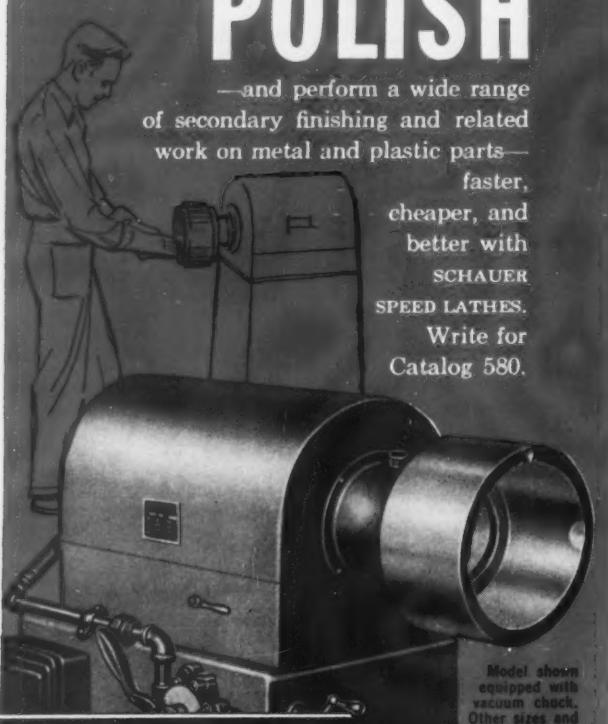
POLISH

—and perform a wide range of secondary finishing and related work on metal and plastic parts—

faster,
cheaper, and
better with

SCHAUER
SPEED LATHES.

Write for
Catalog 580.



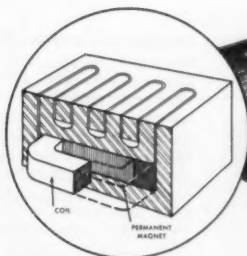
Model shown equipped with vacuum chuck. Other sizes and types available.

SCHAUER

MANUFACTURING CORP.

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NEW**COLD OPERATING**

ELECTROPERM Chucks

Combining the advantages of both electric and permanent magnetic chucks, this new cold operating chuck represents the ultimate in precision for large magnetic chucks. The chuck is only energized and deenergized electrically while permanent magnets do the actual holding during

machinery operation. Energizing and deenergizing cycles are so short that heat and accompanying distortion are eliminated. The cold operating Electroperm Chuck is so stable dimensionally that it will hold the precision tolerances of the machine tool upon which it is mounted.



Write for Catalogue WPL60 showing the complete Walker line of demagnetizers, magnetic and vacuum chucks.

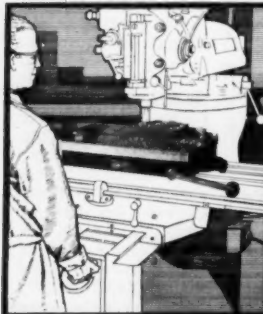
O.S. Walker
COMPANY, INC.
ROCKDALE ST., WORCESTER 6, MASS.

WALKER CERAMAX CHUCKS

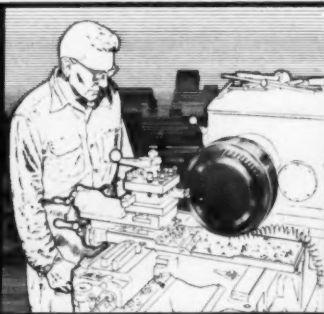
Versatile Walker Ceramax Chucks featuring ultra-permanent ceramic magnets are successfully applied on grinders, millers, lathes, shapers and many other type machines. Powerful, rugged and stable, these permanent magnetic chucks can handle large heavy pieces or small thin stock with equal ease. The all

steel top plate minimizes redressing and provides a long wearing precision work surface. Focused flux keeps the magnetism down near the top plate and away from the spindle and other machine parts. Alternating north and south poles of equal strength keep cutting tools demagnetized.

MILLING



TURNING



GRINDING



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free literature . . .

Tape Controlled Turret Drills

Burgmaster Corp., 15001 South Figueroa St., Box 311, Gardena, Calif. A 16-page bulletin includes complete description and lists the specifications for the 10 tape controlled systems available on Burgmaster Turret Drills, together with 4 pages of case histories of actual installations and the benefits and advantages derived from their installation.

For more data circle 27 on Postpaid Card

Precision Metalworking Equipment

Di-Acro Corp., 576 Eighth Ave., Lake City, Minn. This 32 page catalog covers a line of precision metalworking equipment, including benders, rod parters, spring winders, leaf brakes, press brakes, shears, notchers, rollers, punch presses, press brake dies, single station punches and dies and adjustable punches and dies.

For more data circle 28 on Postpaid Card

Marking Devices

M. E. Cunningham Co., 1051 Chateau St., Pittsburgh 33, Pa. More than 200 marking tools, fixtures and automated machines are detailed in a 48-page Catalog No. 300, in color. The hand tools range from a dozen styles of steel stamps, through more than twenty type holders. Also included is data on press type holders and many types of special application marking tools and partially and fully automated marking machines.

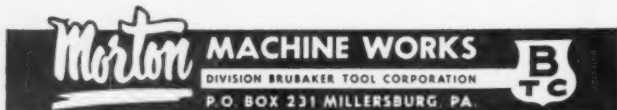
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No Air...No Hydraulics!

The MORTON JIG-NUT provides controlled pressures up to 5000 lbs. at a flip of the wrist. Uniform stroke operation, quickly adjustable, shake and vibration proof — JIG-NUT is simple in design and operation. Readily adapted to many clamping and locating set-ups.

For descriptive literature, please contact your Morton distributor or . . .



Representation Available in Several Choice Areas.

For more data circle 409 on Postpaid Card

Tool Holders

DeVlieg Microbore Div., Fair St., Royal Oak, Mich. A 4-page, illustrated brochure, No. FC-2-61, describes built-in features of Flash-Change Tool Holders, which allow cutting tools at machines to be changed in seconds, and also illustrates and details styles and adapters available for a wide range of machine tool spindles. Also covered are advantages of using the tool holder with Microbore precision tooling.

For more data circle 30 on Postpaid Card

Presses

Dechert Dynamics Corp., Palmyra, Pa. The air clutch mechanism available on Zeh & Hahnemann and Robinson industrial presses is the subject of this illustrated two color industrial brochure. It describes advantages of the clutch and how it makes increased production and reduced maintenance possible.

For more data circle 31 on Postpaid Card

Optics in Gaging and Tooling

Engis Equipment Co., Div. of Engineering and Scientific Instrumentation, 431 South Dearborn St., Chicago, Ill. This paper, which includes photos of many of the instruments used in optical tooling and gaging, is designated as number 10 in a series devoted to metrology. It is entitled "Optics in Gaging and Tooling—Today and Tomorrow" and discusses the essentials of optics application; optical engineering tools; interferometry; principles and applications of optical instrumentation.

For more data circle 32 on Postpaid Card

Axle Lathes

Farrel - Birmingham Co., Inc., Consolidated Machine Tool Div., 565 Blossom Rd., Rochester 10, N. Y. An informative ten-page bulletin 3001-A describes the Farrel-Sellers Dual-End Drive Journal Truing and Axle Lathes. Included are details describing the design and operating features, optional equipment available and complete specifications.

For more data circle 33 on Postpaid Card

Rolled Worm Threads

Landis Machine Co., Waynesboro, Pa. Booklet fully illustrates and describes the general rules of design and practice for rolled worm threads. Illustrations are also included.

For more data circle 34 on Postpaid Card

Wheel Balancer

Norton Co., Worcester 6, Mass. Catalog Supplement describes the Norton Automatic Wheel Balancer for ultra-fine finishes on precise grinding jobs. Details and illustrations are also included.

For more data circle 35 on Postpaid Card

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FISKE'S 604-A HOT DIE LUBRICANT FISKE'S BMI-4 HOT DIE LUBRICANT

Successfully used for extruding in the 1500°—2300° temperature range. Recommended for working titanium, zirconium, molybdenum, copper, regular and naval brass and bronze.

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A graphited lubricant for forging, upsetting, extruding and forming brass, copper, aluminum and steels including stainless steels.

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For tapping high-temperature alloys and high-hardness, high-strength steels and titanium alloys, Winter Brothers high-speed steel, 4-flute plug taps with a special surface treatment assure maximum tap life.

Whatever your tapping problem with super-strength alloys, the Winter Service Engineer will recommend the *right* Balanced Action taps for the job. Just send a description or print of the work, the material to be tapped and the Rockwell C-scale rating.

Write, too, for a copy of "Metal Cuttings," which comprehensively covers tapping of super-strength alloys.

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Air Chucks

Erickson Tool Co., 34354 Solon Rd., Solon, Ohio. A 2-color, 4-page Catalog L describes three styles of air chucks for work or tool holding in rotating or non-rotating applications. Full specifications are included for the 400, 500 and 600 series of '01, '09 and 1-type chuck styles and engineering drawings show how the air chucks work. Also included are a complete specification table of Erickson collets, and illustrations of several applications of the air chucks in a variety of precision, high production work.

For more data circle 36
on Reader Service Card

Lap Grinders

Speedlap Corp., 3636 W. Oakton St., Skokie, Ill. Color bulletin S-161 features and illustrates lap grinders. Information on accessories and service are also included in the bulletin.

For more data circle 37
on Reader Service Card

Pneumatic Products

C. A. Norgren Co., 3400 South Elati St., Englewood, Colorado. Catalog No. 1000 covers the complete Norgren line of pneumatic products. The 64 pages describes compressed-air-line filters, pressure regulators, air-line lubricators, valves and other products. In addition, there is a section devoted to useful engineering information such as a compressed-air flow chart, moisture content of saturated, compressed air, dimensional data and other information.

For more data circle 38
on Reader Service Card

Cylinder Accessories

Hannifin Company, Dept. 166, 501 South Wolf Rd., Des Plaines, Ill. A reference bulletin provides a method for quick identification of mounting accessories for square-type, industrial hydraulic and pneumatic power cylinders. Cylinder mounting accessories described and fully cataloged are the female rod clevis, female rod eye, clevis bracket, mounting plate and pivot pin.

For more data circle 39
on Reader Service Card

Rotary Tools

M. A. Ford Mfg. Co., Inc., Davenport, Iowa. A six-page Bulletin No. 102, a supplement to Catalog No. 60, illustrates and lists the Ford series of end mills, Hi-Roc drills, spiral flute drills, reamers, ground cutters and unflute countersinks in both carbide and high speed steel. Sizes and prices are also listed.

For more data circle 40
on Reader Service Card

Soluble Concentrates

Michigan Tool Company, Shear-Speed Chemical Products Div., 7171 E. McNichols Rd., Detroit 12, Mich. 26 different types of Shear-Speed cutting fluids and lubricants are covered in a 52-page catalog. Data on fluids of the same type are listed on pages of the same color so fluids can be selected by application. Soluble concentrates are covered in three sections. Physical and chemical properties, typical uses and descriptions of each are conveniently tabulated. Features and uses of each fluid are discussed, along with application hints and dilution tables for soluble concentrates.

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**INTERCHANGEABLE
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**rugged, economical,
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National Splined-Taper Drive Counterboring Tools offer real on-the-job economy for heavy duty counterboring operations. A single, rugged shank and holder socket accommodates a wide range of counterbore and countersink cutters, thus keeping tooling costs at a minimum.

Taper shank and socket construction assure permanent alignment and rigidity. Spline keys offer jam-proof, twist-proof performance, even under severe conditions.

Manufactured in a complete selection of individual stock sizes, National Counterboring Tools are also available in five basic assortments to meet the requirements of most tool rooms and small shops. Investigate these rugged, economical tools from National today . . . your only source for tools "plus"!

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MODERN MACHINE SHOP

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Numerically Controlled Turret Drill

Fosdick Machine Tool Co., Cincinnati 23, Ohio. Bulletin No. FTD-1 describes the Fosmatic Numerically Controlled Turret Drill—a complete drilling department in one machine. 32 spindles in a revolving turret hold enough tools for hundreds of drilling, tapping and milling operations. Numerical control, with mathematical precision, ups production and practically eliminates scrap with this machine.

For more data circle 42 on Postpaid Card

Surface Grinder

Landis Tool Co., Waynesboro, Pa. An 8-page color Catalog 1½-60 describes and illustrates the improved Landis Abrasive No. 1½ Precision Surface Grinder. Specifications are also included.

For more data circle 43 on Postpaid Card

Engine Lathes

R. K. LeBlond Machine Tool Co., Madison at Edwards Rd., Cincinnati 8, Ohio. Bulletin No. R-215 features a description of the forces of turning that every lathe must withstand to maintain its accuracy, and how Regal design features negate these forces. Specifications and

operating descriptions of the Regal 17 inch and 19 inch plain and sliding bed gap lathes are also included.

For more data circle 44 on Postpaid Card

 <p>Severance ELECTRODE DRESSING CUTTERS</p> <p>Used by many to re-condition Electrodes without removing from machines—</p> <p>Down-time is Slashed!</p> <p>Production is Increased!</p> <p>Designed to fit most all popular Electrode Dresser power tools.</p> <p>Special shapes quickly made up.</p> <p>INVESTIGATE!</p> <p>It may pay you much!</p> <p>ASK FOR MORE INFORMATION TODAY!</p>  				<p>MIDGET MILLS</p> 
				<p>CHATTERLESS COUNTERSINKS</p> 
				<p>BALL SEAT REAMERS</p> 
				<p>CARBIDE END MILLS</p> 
<p>INSIDE DEBURRING CUTTERS</p> 	<p>OUTSIDE DEBURRING CUTTERS</p> 	<p>TUBE END DEBURRING CUTTERS</p> 	<p>CARBIDE HAND FILES</p> 	
<p>HAND DEBURRING CUTTERS</p> 	<p>DISC CUTTERS</p> 	<p>DRILL COUNTERSINKS</p> 	<p>SPECIAL CUTTERS</p> 	
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Chucks

Sutton Tool Co., Sturgis, Mich. The 20-page Bulletin No. 70 contains 57 illustrations showing different types of collet chucks, diaphragm chucks, mandrels, arbors, collets, boring bars, adapters, spindles and other work-holding devices of special design, both power operated and mechanically operated.

For more data circle 45 on Postpaid Card

Corrosion Resistance

Wall Colmonoy Corp., 19345 John R St., Detroit 3, Mich. Technical Data Sheet No. T-1 lists the corrosive media in which nickel alloys are generally resistant and discusses corrosion resistance in general terms. A bar chart is also included.

For more data circle 46 on Postpaid Card

Arc Welding Products

Lincoln Electric Co., Dept. 2421, Cleveland 17, Ohio. Color Bulletin 7000.7 entitled "Weldirectory of Arc Welding Electrodes, Equipment, and Supplies" presents information on AWS electrode classification and discusses correct electrode selection for every type of welding application.

For more data circle 47 on Postpaid Card

Dividing Head

International Machine & Tool Corp., Warwick Industrial Park, Providence 5, R. I. A four-page, color brochure describes the Optigon B11 Optical Dividing Head with optical projection system. Besides the checking of true circular divisions or angles, the head is very useful in production, measurement and testing of gears, keyways, controller cylinders, camshafts and so on. Illustrations, information on accessories and technical data are also included in the brochure.

For more data circle 48 on Postpaid Card

Balancers

Stewart - Warner Corp., Dept. YY-100, 1850 Diversey Parkway, Chicago 14, Ill. A 16 page catalog in color, Form 24-1, gives detailed features and uses of all models and types of Stewart-Warner Electronic Industrial Balancers. Also sections of the catalog explain maintenance balancing, service shop balancing and production balancing and advantages and economics of balancing.

For more data circle 49 on Postpaid Card

Grinding Tools and Drilling Equipment

Dumore Company, 1302 17th St., Racine, Wis. A four-page color Bulletin G-60-C covers the Dumore line of portable, precision grinding tool and small hole drilling equipment.

For more data circle 50 on Postpaid Card

Punching and Notching Equipment

Wales Strippit, Inc., Akron, N. Y. A 15-page general Catalog in color on the Strippit System which includes punching, notching, nibbling and drilling equipment.

For more data circle 51 on Postpaid Card

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2,884,038

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2,923,340

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LED-LOK is the perfect seal for hydraulic applications as well as air and any type gas . . . gives good results in minor vibration problems.

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Set Screws

Standard Pressed Steel Co., Box 556, Jenkintown, Pa. The three important "holding powers" of a properly tightened set screw are analyzed in an eight-page technical Bulletin, Form 2067, entitled "More About Unbrako High Torque Set Screws." Illustrations include microphotographs of grain, structures and tabulations of holding power.

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JOHNSON model M-Mobile

The right saw in the right place pays for itself—fast! The Johnson Model M metal cutting band saw eliminates all hand cutting. It will cut anything on the job including time and labor costs. Completely portable, mounted on big rubber-tired wheels, it handles easily and it's simple to operate. Preferred by contractors because it's built to last, can be used indoors or out and so economical to buy and operate.

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Drill Presses

Electro-Mechano Co., 265 East Erie St., Milwaukee 2, Wis. A four-page color bulletin on high speed precision drill presses, illustrates the company's standard machine, drilling motors and multiple head base. Construction details and specifications are also included.

For more data circle 53 on Postpaid Card

Proficorder

Micrometrical Mfg. Co., 3621 South State Rd., Ann Arbor, Mich. An eight-page, four color brochure on the Proficorder describes in detail measuring and recording roundness, flatness and roughness, waviness, scratches, flaws and surface profiles. Also included are many typical profile records showing a wide variety of surfaces.

For more data circle 54 on Postpaid Card



specifications

- Capacity — 5" rounds, 10" flats
- Height (closed) 30"
- Blade length — 7'5" x 1/2" x 23 ga.
- Blade Speed — 45, 90 and 150 ft. per min.
- Motor — 1/3 H. P., any voltage with 25' ext. cord
- Traction Wheels — solid, rubber tread, 12" dia.
- Built-in blade, cord and tool compartment

Tool Bit

Firth Sterling, 3113 Forbes Ave., Pittsburgh 30, Pa. Catalog covers three standard grades of high speed tool bits with typical analyses, recommended uses, sizes, standard package quantities and prices. Also included is a selection guide.

For more data circle 55 on Postpaid Card

Wheel Forming Attachment

Parker - Hartford Corp., 700 Franklin Ave., Hartford, Conn. A six-page brochure, in color, describes an attachment to dress grinding wheels optically. Illustrations are also included.

For more data circle 56 on Postpaid Card

Machining

Globe Tapping Machine Co., 1251 Central Ave., Bridgeport 7, Conn. Catalog illustrates and describes in detail a line of machines for high speed automation. Several applications discussed in detail explain how quality standard may be improved. Complete specifications are shown on available standard machines. For more data circle 57 on Postpaid Card

Coatings

Service Products Div., Johnson's Wax, Racine, Wis. Four-page folder entitled "Special Coatings" describes 18 special industrial coatings for all types of metal-using industries. Description includes data on methods of application, coverage, drying time and characteristic uses of these coatings on surfaces of many types of materials.

For more data circle 58 on Postpaid Card

Universal Plugs

Moore Products Co., H & Lycomings Sts., Philadelphia 24, Pa. Bulletin 8009 describes and illustrates universal plugs for Moore Pneumatic and Comparator Gages. Dimensions and specifications are also listed in the bulletin.

For more data circle 59 on Postpaid Card

Sharpener

Punch Products Corp., 370 Babcock St., Buffalo 6, N. Y. Catalog 1125, in color, fully describes and illustrates the Unipunch Universal Punch and Die Sharpener. The sharpener is a self-contained, portable, bench-type and is equipped with a built-in universal fixture.

For more data circle 60 on Postpaid Card

Measuring Machine

Sheffield Corp., Dayton 1, Ohio. A four-page brochure, in color, illustrates and describes the Ferranti FI-22 coordinate measuring machine. Features and specifications are also included.

For more data circle 61 on Postpaid Card

Power Presses

Johnson Machine & Press Corp., 620 West Indiana Ave., Elkhart, Ind. Catalog No. 60 lists complete specifications on 50 models of company's line of power presses, including straight side, inclinable, horn and gap.

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10,000 psi Oil
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Shop Air!

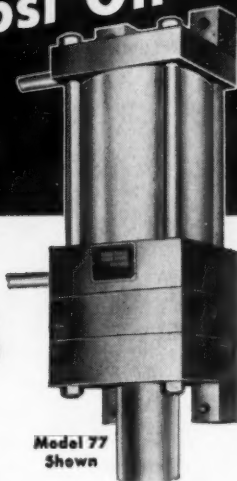


AIR TO
HYDRAULIC

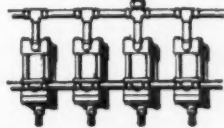
BOOSTERS

No Pumps or High Pressure
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Hook a Miller Air-Hydraulic Booster to your air line and get INTENSIFIED (ratios up to 100 to 1) Hydraulic Power that you can vary and control at will and use for such common shop operations as punching, clamping, pressing, riveting, shearing, welding, crimping, testing, etc. High pressure booster output drives the hydraulic work cylinders and can be directly applied (without cylinders) in testing, measuring, other applications. Boosters save air, space, weight, require little or no maintenance, and hold pressure as long as desired without additional power consumption. Models for immediate delivery.



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Metalworking Equipment

Yoder Co., 5532 Walworth Ave., Cleveland, Ohio. A metalworking equipment publication entitled "Yoder Product News" is a report on product development and new applications of metalworking equipment lines, pipe and tube mills. Complete specifications are listed and photographs show entry side and run out end of the equipment.

For more data circle 63 on Postpaid Card

Standard and Special Tools

Plew Tool Corp., South Line St., Columbia City, Ind. A 23-page booklet describes and illustrates standard high speed tool bits and cut-off blades, special tools forming and radial relief and standard tools for cold heading and nut forming.

For more data circle 64 on Postpaid Card

Motorized Spindles

Pope Machinery Corp., 261 River St., Haverhill, Mass. Bulletin S-23 contains complete specifications on a comprehensive line of high

precision motorized spindles having a vibration amplitude of but twenty-five millionths of an inch and maximum shaft runout of only seventy-five millionths.

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TORIT



Torit Cyclone Separator Model.

High efficiency collection of all types of dust, chips and shavings. Up to 95% of the dust is removed from the air, drawn into the top of cone by centrifugal force, and settled to the dust reservoir below. Clean air is exhausted outside the building or indoors through after filters.

Self contained, compact, portable steel units. End mounted motor and blower mounted in free air for cool operation, is detachable for servicing or relocation of outlet. Cones can be rotated for proper inlet location. Dust reservoir has pull-out drawer for easy cleaning. Individual capacities range up to 6500 cubic feet per minute. Larger units are built on special order.

Prices start at \$335.

DUST COLLECTORS STOP LOSSES CAUSED BY DUST

- machine wear
- absenteeism
- product damage

With a Torit Dust Collector, machines stay clean, hold close tolerance up to 80% longer. Dust is kept off bedways, slides, and bearing surfaces. There are fewer accidents because work areas are clean and safe. Employees work more efficiently in clean air, their health protected. And there is no dust in the air to harm fine product finishes.

- * For a FREE handbook detailing specifications and performance data of Torit Dust Collectors and applications, write Dept. 730

TORIT MANUFACTURING CO.

1133 Rankin St. • St. Paul 16, Minn.

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Turret Lathe

Warner & Swasey Co., Cleveland 3, Ohio. Brochure covers design highlights, specifications, and attachments for the No. 3 universal ram type turret lathe. Also included are photographs and descriptions of five optional lathe attachments designed to give increased versatility on specialized work.

For more data circle 66 on Postpaid Card

Air Cylinders

Sheffer Corp., 326 West Wyoming Ave., Cincinnati 15, Ohio. 20-page, full color, Bulletin No. 161 describes new series of dimensionally interchangeable 250 p.s.i. cushion type air cylinders.

For more data circle 67 on Postpaid Card

Profile Grinder

Star Cutter Co., 34500 Grand River Ave., P. O. Box 376, Farmington, Mich. A two page two color catalog sheet (SC-154) describes the Star No. 3 Profile Grinder; a floor-type tilting-table machine that grinds or polishes contours and irregular shapes.

For more data circle 68 on Postpaid Card

Cut-Off Machine

Rockwell Mfg. Co., Delta Power Tool Div., 486 North Lexington Ave., Pittsburgh 8, Pa. A eight-page, illustrated bulletin describes the Delta 12-Inch Cut-Off Machine. Operational photographs describe the precision engineered features that save production and promote operating economy. Also included are specifications and listings of all motors and motor controls.

For more data circle 69 on Postpaid Card

Driving Centers

PowerGrip, Inc., Rockfall, Conn. Catalog 50361 describes a radically new type of driving center that is said to reduce production time. Complete information on dimensions and instructions for ordering from the complete stock of assembled centers are included.

For more data circle 70 on Postpaid Card

Testing Machines

Steel City Testing Machines, Inc., 8823 Lyndon Ave., Detroit 38, Mich. Two color, four-page, Bulletin G-361 describes the company's complete line of testing equipment. Brinell hardness testing machines, Penetrascopes, ductility

testers, tensile and compression testing machines, transverse testers, hydrostatic and pneumatic testing machines, proving rings and calibration presses and special testing machines are discussed.

For more data circle 72 on Postpaid Card

Comparator and Measuring Machine

Jones & Lamson Machine Co., 521 Clinton St., Springfield, Vt. 6-page color brochure describes Models FC-14 and TC-14 Optical Comparator and Measuring Machines for practically any optical projection job.

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HARIG FAST-ACTION VISES FOR PRODUCTION ... MACHINE SHOP



JAWSET

Adjustable production vise. After Jaw is set in position, hundreds—thousands—millions of pieces may be run off with a mere flip of a lever.

**BOTH VISES FOR DRILLING • GRINDING
BORING ... JIGS AND FIXTURES**

(locking pressure of 2 tons or better)



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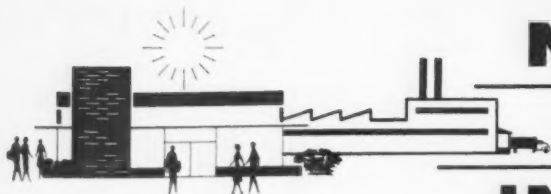
All-purpose tool room and machine shop vise. Quickly adjustable to various sizes of work.

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NEWS OF THE INDUSTRY

EUGENE W. FULLER APPOINTED DIRECTOR OF ILLINOIS TOOL WORKS

Eugene W. Fuller, Executive Vice President, Illinois Tool Works, Chicago, Ill., was elected a Director at the Company's recent annual meeting, according to an announcement by Harold Byron Smith, President.

Associated with ITW since 1928, Mr. Fuller has served in various administrative and executive capacities, particularly in the management of ITW's industrial fastener product lines. He formerly was Sales Manager, and later General Manager, of the Company's Shakeproof Division in Elgin, Illinois. He was elected a Vice President in 1950 and Executive Vice President in 1959.

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SPURLIN NAMED VICE PRESIDENT AND CHIEF ENGINEER OF SYNTRON

William V. Spurlin has been named vice president and chief engineer of Syntron Company. Mr. Spurlin fills the vacancy created by the retirement of E. J. Missien, who was vice president in charge of engineering. Mr. Spurlin came to Syntron Company as development engineer in 1946 from the Baldwin-Lima-Hamilton Corporation, Hamilton, Ohio. In 1958 he was named chief engineer of Syntron, a post he held until present appointment.

NEW APPOINTMENTS AT LANDIS MACHINE

D. E. Stoner, former Works Manager of the Landis Tap Division, has been appointed Works Manager of the entire plant of Landis Machine Co., Waynesboro, Pa., upon the retirement of Leon H. Randolph. R. D. Helm, former Assistant Treasurer, is now Secretary-Assistant Treasurer upon the retirement of R. G. Mumma, Company Secretary.

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UNIVERSAL VISE ACQUIRES SWARTZ JIG AND FIXTURE LOCK PRODUCT LINE

The Universal Vise and Tool Company of Parma, Michigan announces the acquisition of the standard pump jig and fixture lock product line of Swartz Tool Products Company of Detroit. Swartz Tool Products Company will continue to manufacture special tooling and fixturing in Detroit.

The Universal Vise and Tool Company will manufacture and market the Swartz Standard Fixture and Lock line from its plant at Parma, Michigan, under a new division to be known as Swartz Standard Fixture Division. In addition to the Swartz line of products, Universal manufactures a complete line of machine tool vases, machine clamps and rotary spacing and indexing equipment.

LATROBE PURCHASES INTEREST IN CAST MASTERS

Latrobe Steel Company, Latrobe, Pennsylvania, has announced the purchase of a majority interest in Cast Masters, Inc., Racine, Wisconsin, a development foundry specializing in the production of large precision castings for the pattern making and tooling fields. The move, according to a company spokesman, will enable Latrobe Steel Company to supply more helpful technical data to the increasing number of independent firms making smaller cast tool components, and at the same time enable his company to more actively participate in the rapidly growing field of precision cast tooling.

★ m m s ★

GISHOLT VICE PRESIDENT TO RETIRE

Robert H. Bruce, Vice President in Charge of Sales for Gisholt Machine Company, Madison, Wisconsin, will retire June 24, 1961. His duties will be assumed by Robert H. Presnall, who has been appointed General Sales Manager.

Mr. Bruce has been with Gisholt Machine Company since 1934. Prior to his appointment as Vice President in Charge of Sales he served as General Sales Manager, Assistant General Sales Manager and also had wide experience in the sales and engineering departments.

Mr. Presnall joined Gisholt Machine Company in 1944 as a special tool designer. He has served as an ex-

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RIBBON COVERS**

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Outline your problem for a prompt reply or send for complete literature.

Elasticones are metal-formed, cone shaped covers that open and close automatically to provide protection against dirt, damage, and catching of limbs, for all precision moving parts. Available in all finishes and sizes from $\frac{3}{8}$ " diameter up to 60" long.

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news of the industry . . .

port and domestic sales correspondent and was supervisor of Gisholt's estimating department. In 1951 he became District Sales Manager of Gisholt's Pittsburgh office.

Mr. Bruce was transferred to the main office of Gisholt in Madison in 1959 when he became Assistant sales Manager.

**TAFT-PEIRCE APPOINTS
THREE VICE PRESIDENTS**

F. Steele Blackall, III, President of the Taft-Peirce Manufacturing Company of Woonsocket, R. I., has announced appointment of three new Presidents: Franklin Meyer, Jr., Engineering; Kenneth H. Williamson, Manufacturing; and John G. Zeiger, Marketing; and a new Metallurgical Director, Dr. Walter M. Saunders, Jr.

Mr. Williamson and Mr. Meyer will direct the activities of two newly formed divisions, created as a result of a "functional realignment of the company's organizational structure." Mr. Williamson will be in charge of all manufacturing. Mr. Meyer will head the Engineering and Controls Division, a consolidation of all engineering and related activities. Mr. Zeiger will continue to direct the company's marketing program.

FAST FRICTION SAW



FOR CUTTING OF STRUCTURALS— RAIL, PIPE AND BAR STOCK

These revolutionary new friction saws are one-piece construction . . . need no expensive pits . . . can be moved quickly and cheaply. New coolant system keeps cut hot, blade cool . . . electronic pressure feed eliminates complicated hydraulic system . . . varies pressure as blade moves through different thicknesses. Steel safety shroud reduces noise level . . . stops flying sparks.

FREE BROCHURE
TY-SA-MAN Machine Co., Inc.
1101 White Ave., Knoxville, Tenn.

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★ m m s ★

TORRINGTON RECEIVES AWARD

The Hamilton Standard Division of United Aircraft Corp., Windsor Locks,

Conn., has presented The Torrington Company, Torrington, Conn., with its highest quality classification award. The Torrington Company is the second bearing manufacturer to receive this top rating under an Accreditation Program set up to evaluate the quality control systems of Hamilton Standard suppliers. The certificate was given after a review of The Torrington Company's quality control system in action.

CHANGES IN ORGANIZATIONAL ALIGNMENT FOR HEALD

The Heald Machine Company has announced changes in its organizational alignment. The company will be organized into two main divisions by product line—the Grinding Machine Division and the Bore-Matic Machine Division.

A. Francis Townsend, formerly Vice President-Engineering, has been

Two Hardness Testers in a Single Instrument

The new Wilson Rockwell TwinTester combines in one instrument the functions of both a Rockwell and a Rockwell superficial hardness tester. Designed primarily for use in such areas as tool departments, maintenance repair shops and laboratories, the TwinTester offers many outstanding features.

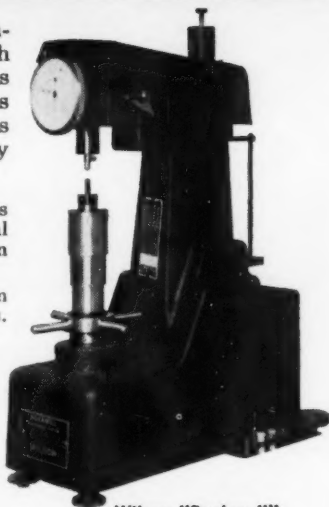
Large direct-reading dial is marked with B and C scales for Rockwell hardness, and N and T scales for superficial Rockwell hardness readings. Just one zero set position for all scales.

Easy to operate, the TwinTester can be changed from Rockwell to Rockwell superficial testing in seconds.

Complete equipment includes cowl, ball penetrator for B and T scales, Rockwell test blocks, anvils, dust cover and protective sleeve set.

A complete line of Wilson Rockwell instruments is available, including semi and fully automatic models. Wilson "Brale" Diamond Penetrators assure perfect readings every time.

Write for details—Ask for Catalog RT-58. It gives complete information on the TwinTester as well as on the full line of Wilson Rockwell hardness testers.



Wilson "Rockwell"
TwinTester

WILSON "ROCKWELL" HARDNESS TESTERS

**Wilson Mechanical Instrument Division
American Chain & Cable Company, Inc.**

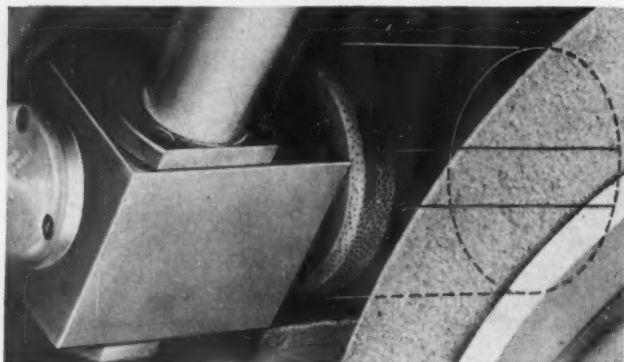
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news of the industry . . .

named Vice President, Manager of the Grinding Machine Division, while Albert A. Arbogast, formerly Branch Manager of the Company's Detroit Sales Office, has been made Manager of the Bore-Matic Machine Division. G. Harding Allen has been appointed Works Manager for the company and Edwin J. Keyes, formerly Vice President and Works Manager becomes Vice President of Manufacturing.



**NEW TRU-GRIT® ROTARY DIAMOND
DRESSING TRAVERSE WHEEL CONTROLS
GROUND FINISHES, CUTS COSTS**

Hundreds of overlapping diamond points produce uniform dress every time, guarantee control of finish on workpiece. Quick, straight pass at regular intervals keeps wheel sharp, free-cutting, uniform. Minimum infeed; almost no wear on dresser or grinding wheel. First set-up lasts until tool is replaced; no downtime each shift. Big savings. Typical power-driven set-up ran for 10,930 dressings and 1,366,512 controlled finish grinds before being replaced. Finishes are within 30-55 rms range. Finer finishes in 12-18 rms range by using contact-driven unit. Write us about your finish objectives.

WHEEL TRUEING TOOL COMPANY

217-3200 W. Davison, Detroit 38, Mich.

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**THOMPSON NAMED
VICE PRESIDENT OF CERRO**

The appointment of Ivor Thompson as vice president of Cerro Sales Corporation was announced here today by Richard H. Lewin, its president. Cerro Sales Corporation is a subsidiary of Cerro Corporation, a leading U. S. produced and fabricator of nonferrous metals.

Mr. Thompson will be responsible for the marketing of all nonferrous metals produced by Cerro de Pasco Corporation, Cerro's subsidiary oper-

ating in Peru. The major metals sold by Cerro Sales Corporation are copper, lead, zinc, silver, and gold.

★ m m s ★

**JONES AND
LAMSON VICE
PRESIDENT**

At the Board of Directors meeting following the annual meeting of stockholders of Jones & Lamson Machine Company, Springfield, Vermont, Robert S.



Robert S. Jones

Jones was elected Vice-President and General Manager. Mr. Jones started with J & L in February of 1940 as a machine operator. He held, successively, positions as Foreman, Manager of Subcontracting, General Foreman, Asst. to the Supt., Factory Manager, Manager of Manufacturing, General Manager of Products Divisions, and General Manager. All other officers of J & L were re-elected.

REM SALES NAMED NATIONAL DISTRIBUTOR FOR CLEARING-HARRISON LATHES

REM Sales, Incorporated, a subsidiary of The Robert E. Morris Company of West Hartford, Conn., has been named National Distributor for Clearing-Harrison Precision Geared Head Lathes, succeeding Clearing Division of U. S. Industries in this activity. Clearing-Harrison Lathes are

The Answer... TO INDUSTRY'S DEMAND FOR QUALITY, EFFICIENCY AND LOW COST ECONOMY

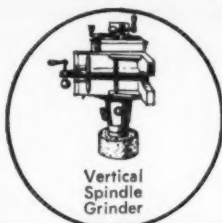
UNITED STATES ELECTRICAL GRINDERS-BUFFERS



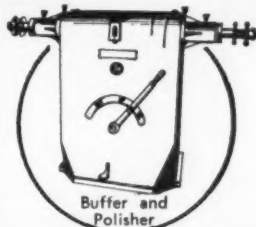
An investment in better, faster, production through the use of tools expertly designed and conscientiously crafted for your particular purpose.



General Purpose
Grinder



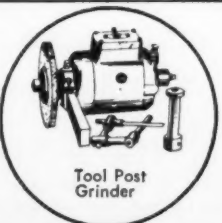
Vertical
Spindle
Grinder



Buffer and
Polisher



Precision Lathe
Grinder



Tool Post
Grinder



Grinder
and
Buffer

"OVER 60 YEARS SERVICE TO INDUSTRY"

WRITE FOR CATALOGS

The United States Electrical Tool Co.
3640 LLEWELLYN ST., CINCINNATI 23, OHIO

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news of the industry . . .

manufactured for the American metal-working market by T. S. Harrison & Sons, Ltd., of Heckmondwike, England, producer of geared head high speed precision lathes ranging in size from 11 inch to 17 inch swing in both standard and hydraulic copying types. Harrison lathes fitted with Hydraulic Copying equipment are actually dual-

purpose machine tools in that Harrison's tracer turning facilities interfere in no way whatsoever with regular toolroom lathe functions of threading, turning, facing, and boring.

To meet the exacting demands of American toolrooms and production departments, all Harrison Lathes feature anti-friction spindles with American Standard Taper-Key noses; hardened headstock gearing honed by American Red Ring gear finishing equipment; induction hardened bed-

ways; heavy-duty motor drives with clutch and brake provision; fail-safe electrical controls; wide speed selection; integral heavy gage cabinet bases; and an overall package design that is pleasing to the eyes and convenient for the operator's hands.

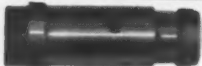
REM Sales Incorporated is well known as National Distributor for Nichols Precision Milling Machines manufactured by W. H. Nichols Company of Waltham, Mass., and Morris-Omega Cold Heading Machines for miniature parts. Clearing - Harrison Lathes will continue to be offered for immediate delivery through a nation-wide network of leading machine tool

Hold Everything!

That's what Modern has been doing with Collets—Pushers—Tubes,—for over Three and one Half Decades.

Progressiveness, along with Experience over the years, has brought about a most reliable and dependable source—"Modern"!

Finished Collets, Pushers, Tubes, Master and Pads are carried in stock,—Available for Immediate Delivery.



BURNS PUSHER

The "Burns" Pusher handles stock without Scratching or Friction;—Also an excellent pusher for Hot Rolled Steel.



DOUBLE SAW TOOTH SERRATED COLLET

Modern Collets are available in all types and sizes for ALL screw machines.



MODERN DUAL-GRIP PUSHERS
for Stock Saving.



PUSHER AND COLLET TUBES FOR ALL SCREW MACHINES

Representatives in all strategic areas.
Phone or write for stock list of finished items—available for immediate delivery.

MODERN COLLET AND MACHINE COMPANY

401 Salliotte St. • Ecorse (Detroit) 29, Mich.

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dealers. A complete bank of spare parts and accessories will be established and maintained by REM Sales with a view toward shipping emergency parts within 24 hours.

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BLAKE ELECTED DIRECTOR OF WARNER & SWASEY

At the Shareholders' Meeting, Charles T. Blake, Director of Engineering of The Warner & Swasey Company, was elected a Director of the Company for a three-year term. Mr. Blake takes the place on the Board which was held by Myron S. Curtis, who has retired. Charles J. Stilwell and Francis H. Beam were re-elected to the Board for a three-year term.

A native of Cleveland, Mr. Blake joined Warner & Swasey in 1935 after graduating from Cornell University with an engineering degree.



Charles T. Blake

After serving as a special apprentice and gaining experience in advertising, sales and purchasing, he entered the Engineering Division in 1953 and was made Director of Engineering in 1957.

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SECO ELECTRONICS PURCHASED BY DI-ACRO

Seco Electronics, Inc., Minneapolis, has been purchased by Di-Acro Cor-



Now, with more than fifty models in the Dustkop line—plus efficient accessory items—the odds are that a standard unit will solve your problem. Dustkop units solve other problems too. They're easier to install, save space and money and are virtually maintenance-free!

how to select a dust collector

This new brochure includes all basic information needed to select the right dust or mist collector for grinding, buffing, polishing and other types of service. Write for your copy. No obligation.



AGET

Manufacturing Company
1398 Church St., Adrian, Michigan



DUSTKOP STOPS DUST

For more data circle 425 on Postpaid Card

news of the industry . . .

poration of Lake City, Minnesota. Seco Electronics is now a wholly-owned subsidiary of Di-Acro Corporation, but will continue to operate with present management under its own name. For Di-Acro Corporation the purchase of Seco is outright diversification. For Seco Electronics, subsidi-

ary status will permit a substantial increase in research and development work. Seco makes specialized electronic test equipment.

★ modern machine shop ★

**CARBORUNDUM'S NEW
ABRASIVE SERVICE CENTER**

The Carborundum Company, one of the world's leading abrasive manufac-

turers, and its subsidiary, Pacific Abrasive Supply Company, which formerly operated separate office and warehouse facilities in the Los Angeles area, have moved their offices and stocks to a new \$1½ million Abrasive Service Center at 2240 South Yates Avenue, Los Angeles, California.

Inventories include a complete line of abrasives running the full range of bonded abrasives such as grinding wheels, abrasive grains and powders, tumbling media and compounds, coated abrasive sheets, rolls, discs and belts. In addition, the Abrasive Service Center stocks a complete line of cutting tools, coolants, super refractories, elec-

FOR THE MECHANIC WHO WANTS THE BEST TOOL



**NEW
WILSON
VERTICAL
PNEUMATIC
GRINDERS**

Wilson Series 923 vertical grinders are excellent for flash removal, snagging, weld smoothing and other metal removing operations. These powerful grinders are particularly suited for metal removal in deep cavity molds and other hard-to-get-at places. Available in threaded spindle and collet chuck models.

All Wilson portable pneumatic production tools are lightweight, compact. • Catalog PT-58 gives all the facts. Write for your copy.

TW916

THOMAS C. WILSON, INC.

21-11 44th Avenue, Long Island City 1, New York

BETTER TOOLS FOR BETTER WORK

For more data circle 426 on Postpaid Card

trical components, barrel finishing machines, and various types of abrasive belt machines.

The new Abrasive Service Center, equipped with 30 carefully selected machines and their supporting facilities, is comprised of three Service Departments—Grinding Wheel Department, Abrasive Belt and Machine Department, and the Barrel Finishing Department. The Center provides a unique educational and training facility on scientific grinding and finishing systems to help Pacific coast manufacturers achieve maximum production efficiency and economy. The Center also provides machine operator training for Carborundum-Pasco, distributor, and customer personnel. It is also used to conduct demonstrations and make method and process evaluations. In addition, the facilities are used to expedite customer order service by altering standard stock items to meet promptly customer requirements for off standard sizes.

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RICE PUMP PURCHASES ILLINOIS DIE FILER MACHINE BUSINESS

The Rice Pump & Machine Company, Belgium, Wisconsin, has expanded its existing product lines of Rice machines for die filing, sawing and stoning, by purchasing the Illinois

die filer machine business from Illinois Tool Works, Chicago. In the transaction Rice acquired all rights for manufacture and distribution, inventories of parts and files, drawings and patterns. Rice's production at Belgium, Wisconsin will be expanded to produce this new equipment, which will be marketed nationally under the Rice trade name through the existing distributors for the company.

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FOR TRUE RADIAL PERFORMANCE— GET A GENUINE RADIAL BY VEET

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Automatic Drill Ejector
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Hardened Column & Way Inserts
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Mfrs. of the VEETMATIC Precision Drilling Machine with Numerical Control and the VEET SPEEDMILLER for Planer Conversion.

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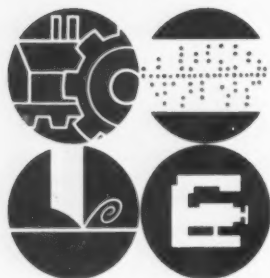
Send for FREE catalog No. 168.

PYROMETER INSTRUMENT CO., INC.
Bergenfield 42, New Jersey

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June, 1961

MODERN MACHINE SHOP 179



NEW EQUIPMENT

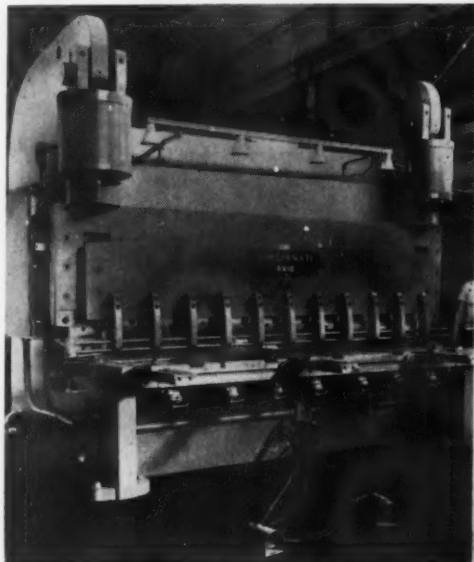
HYDRAULIC SHEAR

The Series 8N10 Cincinnati Hydraulic Shear, equipped with the standard Cincinnati "adjustable rake" feature, which has a nominal capacity of 1 inch by 10 feet mild steel plate, has been announced by Cincinnati Shaper Co., P. O. Box 111, Cincinnati 11, Ohio. The rake of the upper knife is adjustable from 0 to $\frac{3}{4}$ inch per foot. This feature permits the shearing of materials that exceed the nominal capacity of the machine by adjusting the rake upward (maximum mild steel plate shearing capacity of the 8N10 is $1\frac{1}{4}$ inches). When shearing materials lighter than the nominal machine capacity, rake can be adjusted downward to a very low angle to minimize distortion in the back piece. Centralized controls for the adjustment of rake, stroke, power back gauge and start-stop control are convenient to the operator and simple to operate. Ball transfers in the table facilitate materials handling and provide for greater operator efficiency. The gap frame permits the cutting of plates longer than the nominal machine length. Electric foot pedals provide remote control operation of the shear.

The hydraulic drive of the Cincinnati 8N10 is powered by a 40 h.p. motor. The drive unit incorporates a manifold block which brings the valves together in one compact assembly. High pressure joints are reduced to a minimum. The exclusive Cincinnati

clevis-mounted operating cylinders are self aligning; automatic horizontal movement of these units throughout the full rake adjustment insures greater life of piston and cylinder packings. Other important features include hydraulic holddowns, light beam shearing gauge, front gauges and support arms, work chute at rear of machine, inclined ram, interlocked construction, automatic pressure lubrication, and exclusive Cincinnati swivel end-guide bearing.

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Series 8N10 Cincinnati Hydraulic Shear

and

MATERIALS

MULTIPLE SPINDLE LATHE HAS MANY NEW FEATURES

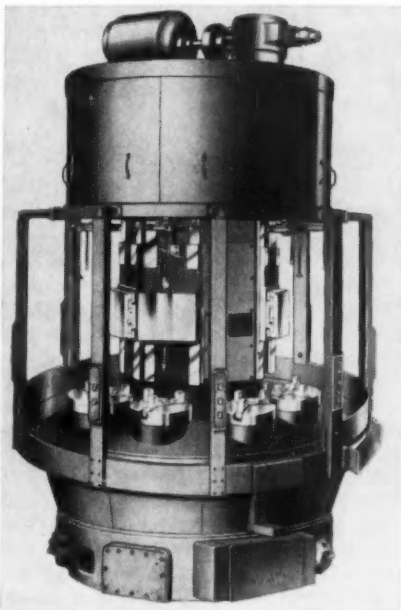
The Type "M", the most recent in the series of Mult-Au-Matic Multiple-Spindle Lathes designed by The Bullard Co., Bridgeport, Conn., was developed to meet industry's demands for a general purpose machine based on the Mult-Au-Matic principal. The Type "M" Mult-Au-Matic contains many new features. It is primarily engineered to take advantage of high spindle speeds, a wide range of feeds, as well as modern cutting tools and materials.

One of the features of the Type "M" Mult-Au-Matic is its space saving characteristics. It is only 90 inches in diameter and stands 142 $\frac{3}{8}$ inches from the floor. It varies in weight from 25,500 to 34,000 pounds, depending upon the number of spindles. The machine is available in six, eight, or twelve spindle sizes. It is powered by an 1,800 r.p.m. 60-h.p. maximum motor. The horsepower of the motor will depend upon the job for which the machine is selected. The motor can be readily connected by means of either alternating current or direct current couplings.

Spindles are mounted on three precision anti-friction bearings to insure proper alignment at all times. This also permits speeds to 400 r.p.m. on six and eight spindle machines and 750 r.p.m. on 12 spindle machines. A conical shaped chip and coolant guard encloses the spindles and prevents

chips from piling up behind the work spindles. It directs chips and coolant to the outer chip trough for easy removal.

Another feature is the heavy duty hydraulically actuated clutch and brake mechanism which is designed with constant follow-up which automatically compensates for wear and eliminates the need for adjustment. To insure proper lubrication at all



View of Bullard Type "M" Mult-Au-Matic

new equipment . . .

times a newly designed lubrication filter system, through which filtered oil is automatically pumped to the feed works and to all other moving parts of the machine, is employed. All bearings and gears of the unit are pressure lubricated.

Widely variable and independent spindle speeds, through the use of change gears, can be obtained at each work station. Feed rates can be varied at each station to suit machining requirements. This type of feed works is based on a cam feed principle. It is equipped with a safety device to protect against overload. Anti-friction bearings are used throughout.

Standard type tool heads are built to meet demands of modern tooling materials and precise machining operations. Accurate positive stops assure and maintain repetitive accuracy. Convenient manual controls are provided for setting up each head. Feeds may be disengaged and re-engaged at any time. Tool heads may be returned to their starting point at will.

For more data circle 75 on Postpaid Card

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MINIATURE INTERNAL GRINDER

The Heald Machine Co., Worcester, Mass., announces its latest addition to the internal grinding field, the Model 090A Centri-Matic for miniature work. The Model 090A has fewer moving parts. The construction of the vibration damped feeding cross slide on anti-friction ways provides a consistent repeatability well within 0.00001 inch. More efficient control and equipment arrangement is effected by complete accessibility through rear door panels for any service inspection necessary. No access is necessary from ends of machine so that equipment may be placed end to end

if desired for economy of floor space and operator attention. The electrical-hydraulic simplification has resulted in 75 percent less hydraulic and an electrical control equipment with cabinet size reduction of 1/3 and approximately half as many components.

An automatic cycle with facility to swivel both the wheel head, with respect to its line of traverse, as well as the workhead significantly improves the accuracy of size and taper. Changeover time has been substantially reduced on this model by use of direct reading micrometer type dials on all major 090A adjustments. For instance, all cross slide positions can be positively and directly set from data sheets without use of a dial indicator setup. To speed wheel change time the cross slide on the Model 090A resets automatically to new wheel dress position, thus saving operator time and skill that were previously necessary.

A direct reading digital dial showing amount of wheel life remaining now allows operator to anticipate time of new wheel change and time avail-



Heald Model 090A Centri-Matic Machine

able for attention to other machines or duties. Work area is completely enclosed, but is easily and readily accessible.

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CENTRIFUGAL TUMBLING MACHINE FOR WET OR DRY PROCESSING

Harper Buffing Machine Co., East Hampton, Conn., has introduced the "Harperizer" Centrifugal Finishing Machine that is designed for deburring parts in wet media as well as for batch finishing in dry media. Former models utilized dry media only.

While the newer Harperizer is built primarily for wet tumbling and deburring, it can be used for dry tumbling as well. Barrels can be made in special shapes for unusual requirements and can be separated into compartments similar to those inside

of the barrels of the larger machine.

The wet tumbler is smaller than the original Harperizer. It has four barrels with 11-inch inside diameters and 18-inch depths. Turret speed varies from 3 to 70 r.p.m. and the barrels themselves revolve at 0 to 200 r.p.m.

But while the latest Harperizer is smaller, production capacity is not reduced in direct proportion to its size. Since loading and unloading time is less, available operating time is increased. One operator can tend several machines.

Typical of the work being processed in the wet tumbler are needles, bearing parts and electronic components. The unit is particularly useful in finishing light parts which tend to "float."

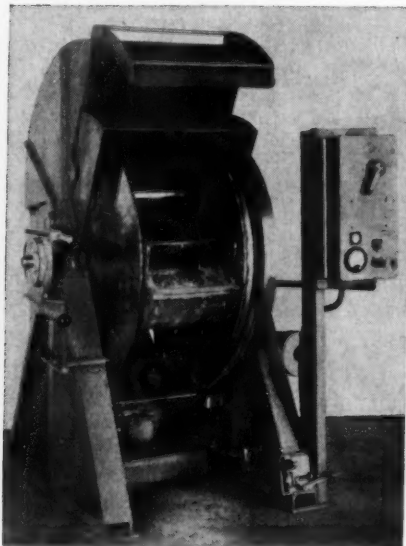
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METAL TREATING PROCESS

The Tufftride process — which is said to make metals stronger and tougher, a new concept for nitriding — is being introduced by the Kolene Corp., 12890 Westwood, Detroit 23, Mich. Applied to any ferrous metal, Tufftriding, it is claimed, increases corrosion resistance (except for stainless steels), raises resistance to galling, provides better wear properties, increases fatigue strength, reduces cracking and raises rolling fatigue limits.

The process has been used experimentally and in production on such parts as crank and camshafts, gears, rocker arms, dies, cylinder liners, engine heads, and so on. It is particularly effective on wear parts where lubrication is difficult or impossible. Tufftriding is a chemical method of impregnating plain or alloy steels, or cast iron with a controlled concentration of nitrogen. As opposed to conventional nitriding, Tufftriding is



Smaller Harperizer for wet processing

new equipment . . .

accomplished in a low-temperature (1050 deg. F.) molten-salt bath. Time at temperature is considerably less so possibility of distortion is minimized. The Tufftride process is not used primarily to form a "case" but the depth of penetration of nitrogen is considerably greater.

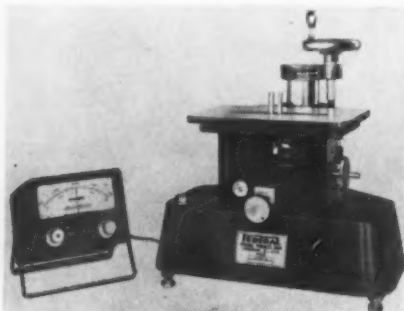
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ELECTRONIC COMPARATOR

An electronic comparator, Model 136B-2, that checks master rings and discs to an accuracy within 2 millionths has been announced by Federal Products Corporation, 1144 Eddy St., Providence, R. I. This comparator can measure inside diameters from 0.040 to 4.760 inch, and outside diameters from 0 to 3.5 inch. These measurements are made with a constant gaging pressure, since the contacts are mounted on a free-floating unit which eliminates all friction. Two scales are immediately available by switching: 11,200X magnification (0.000010 inch grads.) and 2200X magnification (0.000050 inch grads.).

The amplifier is transistorized and battery-powered for greater reliability



Federal Model 136B-2 Electronic Comparator for measuring inside and outside diameters

and instant operation with no source voltage fluctuation. The mercury cell battery pack provides 1200-1300 hours of service. When not required full time for checking masters in the gage laboratory, the completely portable amplifier can be used with an electronic gage head for other measuring applications.

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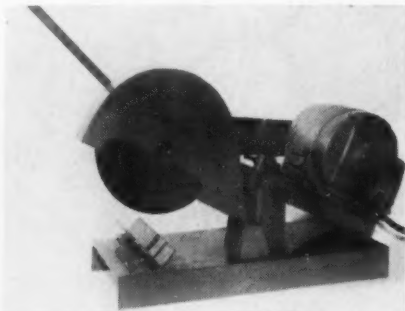
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BENCH TYPE ABRASIVE CUTTING-OFF MACHINE

A. P. deSanno & Son, Inc., Phoenixville, Pa., has announced its Radiac Junior abrasive cutting-off machine, which is a dry cutting bench model. The machine can be used for reamers, taps, drills, thin walled tubing and solids up to 1½ inches. The Radiac Junior has a 3 h.p., 3600 r.p.m., ball bearing motor with a push button starter.

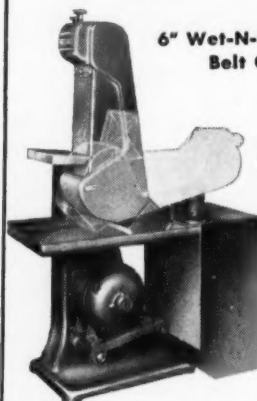
Additional features include a fabricated removable wheel guard; two 4 inch flanges and a cutting fixture with V-block arrangement. The machine, which is designed to use either a 12 or 14 inch wheel, has a base area of 27 by 12 inches and height of 18 inches. The net weight of the unit is 150 pounds.

For more data circle 80 on Postpaid Card



View shows deSanno Radiac Junior abrasive dry cutting-off machine, bench model.

Hammond
OF KALAMAZOO



6" Wet-N-Dri Abrasive
Belt Grinder

For
**FLAT
SURFACING**

- Castings
- Forgings
- Plastics

Vertical or
Horizontal
Operation

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CATALOG

Hammond Machinery Builders

1615 Douglas Ave., Kalamazoo, Michigan

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LEXCO HYDRAULIC LIFT TABLES

Capacities 500# to 2,000# STD.
To 10,000# Special

Portable, adjustable height, Hand or Foot Operated. For lifting and transporting heavy castings, dies, etc., to machines and Presses.

Also DIE HANDLERS—STRIP STOCK HANDLERS

LEXCO ENGINEERING
& MFG. CORP.

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NUMBERALL

CUTS THE COST OF STAMPING NUMBERS

**AUTOMATIC
NUMBERING
HEAD**

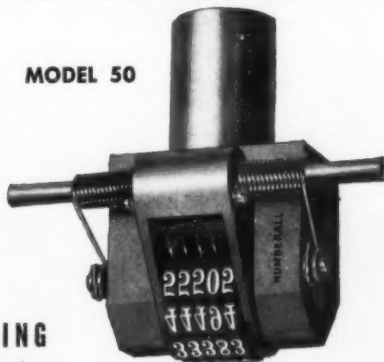
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Rapid consecutive character wheels advance automatically after each stamping. Clear, uniform impressions. Wheel and index plate one piece unit, sturdier . . . greater uniformity. Index plate cannot become loose or out of alignment. Wheels available with Round Face characters for low-strain marking. Write for bulletin 50N.

NUMBERALL STAMP & TOOL CO.
HUGUENOT PARK STATEN ISLAND 12, N. Y.

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MODEL 50

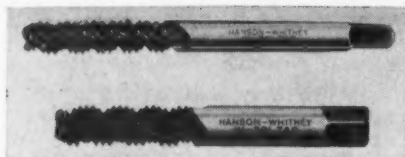


**TO NUMBER
METAL
PRODUCTS**

new equipment . . .

GROUND THREAD TAPS

A ground thread tap, that will produce high quality threads has been announced by The Hanson-Whitney Co., 269 Bartholomew Ave., Hartford, Conn. This tap has true-tangent cutting edges and other major design improvements. These, together with the chip removing advantages of steep-



Hanson-Whitney Ground Thread Taps

spiral flutes, make it possible to tap at high speeds with low torque and great accuracy. In ductile materials,

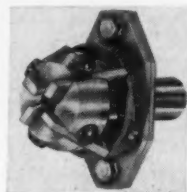
these Hi-Spi Taps will produce uniformly accurate threads at extremely high rates of speed. Standard sizes range from No. 3 through $\frac{1}{8}$ inch in diameter.

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★ m m s ★

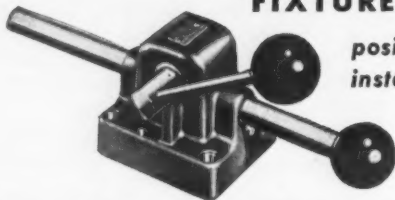
ALIGNING HOLLOW MILLS

Genesee Mfg. Co., 566 Hollenbeck St., Rochester 21, N. Y., has announced aligning type hollow mills, which are designed primarily for Brown & Sharpe and Davenport automatics



Genesee Aligning Type Hollow Mill

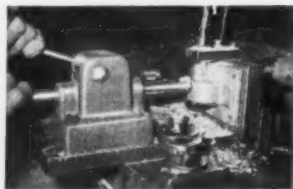
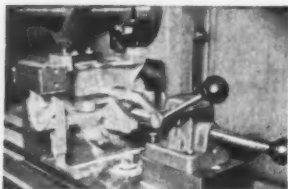
heinrich *Grip-Master* FIXTURE LOCKS



**positive clamping
instant setting**

SIMPLIFY JIG AND FIXTURE DESIGN

LONG TRAVEL provides plenty of chip clearance, easy loading and unloading. Gets into hard-to-reach places. Base sizes: Model 2FL, $3\frac{3}{8}$ " x $3\frac{1}{4}$ "; Model 9FL, $4\frac{3}{8}$ " x $3\frac{3}{8}$ ". Bar lengths from 8" to 18". Here are two examples of Grip-Masters speeding production in drilling and milling operations.



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or Send for Big, Free Catalog
on Heinrich Tools

HEINRICH TOOLS INC., DEPT. 111-F

RACINE, WISCONSIN

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on the NOISELESS LINLEY RIVETER



Cut production costs with the Linley. Quickly produces finely finished rivets. Takes rivets up to 3/4" in diameter in iron and cold rolled steel; even larger sizes in brass, aluminum and other soft metals. Send sample parts to be riveted and without obligation we will give you cost and time estimates of doing the job the easy Linley way.

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Also Builders of Jlg Borers
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REDUCE BORING COSTS



- Saves 80% time in finish sizing holes
- Repeat to .0001" in 30 seconds. No backlash
- Hardened and ground parts
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with

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MMS-61

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For more data circle 434 on Postpaid Card

People work better when they SEE BETTER®

3-D Girl at SKF

Magni-Focuser multiplies the power of this girl's eyes as she inspects a tiny ball bearing at SKF Industries, Inc.



MAGNI-FOCUSER'S

matched prismatic lenses give needle-sharp magnification. Comfortably light weight. Fits over regular glasses. Leaves both hands free. Normal vision may be resumed by lifting head.

MAGNI-FOCUSER

SPEEDS PRODUCTION
With Third Dimensional (3-D) Vision
Leaves both hands free to work

Magni-Focuser—the binocular magnifier—reduces eye-strain and prevents squinting—thereby speeding production, increasing accuracy and minimizing the chance of errors and accidents.

Gauge reading, layout work, inspection, tool and die work are just a few of the jobs that need the Magni-Focuser. Speeds precision assemblies, blue print work. Restores the usefulness of the skilled hands of many older workers whose vision needs a seeing aid.

Magni-Focuser can help your plant produce better. Immediate delivery. 10-day trial without obligation. Return to us if not satisfied. \$10.50

Send for descriptive folder

Edroy Products Co.

Dept. P, 480 Lexington Ave.
New York 17, N. Y.

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new equipment . . .

and are made with straight shanks, to suit these machines. Any machine misalignment can be quickly corrected due to the built-in aligning feature. The mills eliminate separate holders and shorten tool overhang. Style X is recommended for machining materials requiring tools with positive cutting rake. Style R is recommended for machining materials requiring

tools with zero cutting rake. Capacity range is zero to $\frac{3}{8}$ to $\frac{1}{8}$ inch increments.

For more data circle 82 on Postpaid Card

★ modern machine shop ★

IMPROVED GAGE HANDLE

For the precision production line gaging of tapped holes, the C. E. Foster Gage Corp., 5341 English Ave., Indianapolis 19, Ind., has announced an improved gage handle, which is

said to make possible inspection at an unusually high speed. Identified as the Model H D-61, the handle features a unique finger-tip control action, which gives the operator maximum feel of threads and condition of tapped holes; and a thread cleaning brush that makes possible thorough cleaning prior to gaging. The brush



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Economy Elevating Table

- DIE HANDLER
- LOAD LEVELER

- CONSTANT HEIGHT TABLE
- PORTABLE WORK TABLE

Dimensions 24" x 36"
Capacity 2000 lbs.

Lift 24" min. to 42" max.
Price: F.O.B. Chicago \$245.00

Free 10 day trial in your plant with return privilege

**POSITIVE
PERFORMANCE**

Self-locking Acme screws hold load safely, securely, at any height.

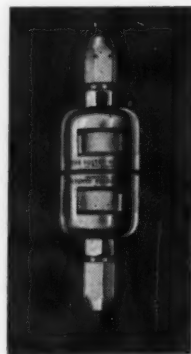
COMPACT DESIGN

No projecting parts — all four sides accessible; crank studs at both ends; three table surfaces.

ECONOMY
ENGINEERING

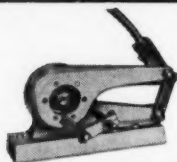
4507 W. Lake St., Chicago 24, Ill.

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**Foster Improved
HD-61 Gage Handle**

DI-ACRO



ROD PARTER

**no burr, no distortion
no further processing necessary**

- Ejectomatic Gauge—gauges, parts and ejects as quickly as rod can be fed
- 11 hole graduated cutting head
- Up to 3/8" rod capacity
- Hand and power models.

See your Di-Acro dealer or write
for information and prices.



pronounced "die-ack-ro"

DI-ACRO CORPORATION

formerly O'Neil-Irwin Mfg. Co.

756 W. Eighth Ave. • Lake City, Minn.

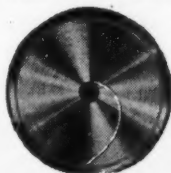
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Troubled by Withdrawal Marks?

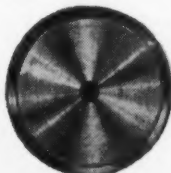
the new RELIEVOMATIC* saves you costly refinishing!

No more rejects or refinishing because of marred surfaces made by cutting tools on their return pass! Now—the RELIEVOMATIC renders precise parts with perfectly smooth surfaces. For boring, turning or facing on automatic metal turning equipment.

Write for complete technical literature.



normal marred surface



perfectly clear surface
with RELIEVOMATIC!

* U. S. Patent No. 2,712,767

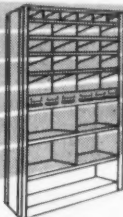
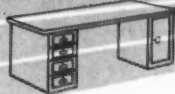
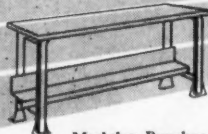
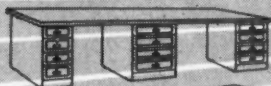
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Nightingale 9-8600

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When you need steel equipment priced right—produced right—and delivered right on time—specify BAY, for integrated service. In long use, all products have proven to be designed properly, produced properly BAY products, unconditionally guaranteed, normally are in stock (including all the new lines) ready for immediate shipment. For top quality products, quick delivery, specify BAY.

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BAY
PRODUCTS DIV.
AMERICAN METAL WORKS INC.

1827 W. Cambria St., Philadelphia 32, Pa.

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new equipment . . .

follows the contour of the threads and brings all dirt and chips to the top.

The Foster Model H D-61 Gage Handle is said to provide ample torque for the toughest jobs yet is ideal for small thread sizes. The all steel one-way ball bearing clutch is claimed to provide trouble-free performance and unusually smooth operation. The long-lasting Mylard slip-

in tapes can be changed by the operator in seconds without special tools. The gage handle is unusually versatile due to easy interchangeability of adapters on one unit. Either A.G.D. Standard Taperlock or reversible adapters may be used.

For more data circle 83 on Postpaid Card

★ modern machine shop ★

PILOT GUIDE POST

A guide post with a relieved pilot section designed for extra ease in

assembling and disassembling die sets has been introduced by Danly Machine Specialties, Inc., 2100 South Laramie, Chicago 50, Ill. The precision pilot guide post has a pilot section just below the top of the post which consists of a narrow band followed by a tapered undercut and which, according to Danly, is accurately ground to provide for maximum ease of assembly and minimum loss of guide.

LW

DIVIDING HEADS

Accurate, Heavy Duty

Ball bearing thrust on worm shaft and rear end of spindle.

Headstock spindle has threaded nose.

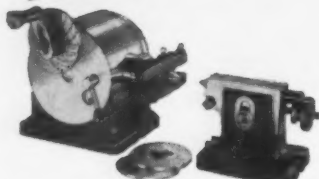
Large tapered bearing adjustable for end play. Head tilts past 90°.

Worm wheel and alloy stress-proof steel worm cuts to close limits for accuracy.

Worm wheel and worm shaft can be fully disengaged.

Complete with three index plates for dividing all numbers to 50 and even numbers to 100 except 961. Index chart shows all divisions obtainable to 380. Specify left (illustrated) or right hand model.

SWIVEL BASE, RISING BLOCKS AND DIRECT INDEXING
MODELS AVAILABLE ON ALL SIZES.



MODEL AU 11" Swing. Fully universal for complete indexing and spiral cutting. Spindle threaded 2 1/4"-10. 3/8" table slot tongues. 190 lbs. **\$460.00**

MODEL SD 6 1/2" Swing. Spindle threaded 1 1/2"-8. 5/8" table slot tongues. 36 lbs. **\$175.00**

MODEL BP 11" Swing for plain milling machines. Spindle threaded 2 1/4"-10. 3/8" table slot tongues. 140 lbs. **\$295.00**



*America's Largest Builders
of Dividing Heads*



LATHE CHUCKS



MAGNETIC CHUCKS



ADJUSTO-QUICK
VISE

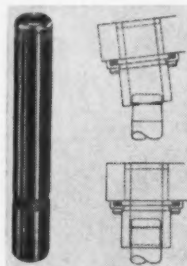


MILLING MACHINE
VISES

LW CHUCK COMPANY

28 So. St. Clair St.
Toledo 4, Ohio

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**The Danly Precision
Pilot Guide Post**

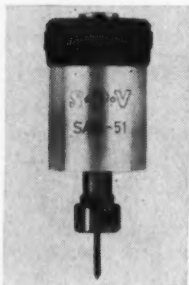
In assembling a die set, the new post assures easy alignment even when the punch holder is not placed squarely on the post. As punch holder is placed in position, the bushing hesitates on the pilot section and, with a pivot action, the bushing comes into alignment with the post. Like all Danly guide posts, the precision pilot guide posts have Microme finish for smooth performance and maximum resistance to wear. The posts are available for immediate use with all Danly Precision Die Sets.

For more data circle 84 on Postpaid Card

★ m m s ★

REVERSIBLE TAPPING ATTACHMENT

Homestrand Machine Tool Corp., 392 West Putnam Ave., Greenwich, Conn., has introduced the reversible SPV Tapping Attachment, Type SAR-



**Homestrand Type
SAR-51, Reversible
Tapping Attachment**

51, specially made for Burgmaster turret drills. The attachment covers thread sizes from No. 0 to No. 8.

For more data circle 85 on Postpaid Card

★ modern machine shop ★

HORIZONTAL AIR GRINDERS

Albertson & Co. Inc., Sioux City, Iowa, has announced the introduction of its Sioux Horizontal Air Grinders.

GOOD ON YOUR LATHES...

VERY GOOD FOR YOUR TURNING COSTS

ACCURATE



LIVE CENTERS

4 complete lines. Over 40 sizes and styles.
All popular tapers for heaviest to lightest work.

If you turn metal, it's just good operating sense to save money with Ideal Live Centers. You'll get accuracy to meet your stated standards, at your turning level and at lowest center point costs. You'll reduce your inventory costs with fast delivery from Ideal distributor stocks. State your requirements, as tight as you like. He'll meet them exactly with the Multi-Duty, Universal, Heavy-Duty or Pipe Point model right for your job. For custom quality at production prices, call on him for all your live center needs.

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MODERN MACHINE SHOP 191



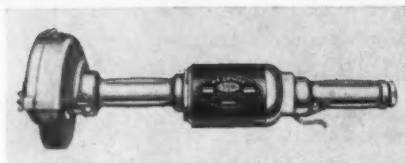
Multi-Duty models for light work and general use. Rigid, accurate. Interchangeable male, female and pipe points.

Sold through
Leading
Industrial
Distributors
In Canada:
IRVING SMITH, Ltd.,
Montreal

**IDEAL
INDUSTRIES, Inc.**
1031-F Park Avenue
Sycamore, Illinois

new equipment . . .

There are two sizes of the tools, the 517 and the 541. They are of similar construction with the 541, the larger of the two. The 517 is available with speeds of 4500 or 6000 r.p.m. with six inch grinding wheel and 9000 r.p.m. with four inch grinding wheel. The 541 operates at 4250 r.p.m. with an eight inch grinding wheel and at 6000 r.p.m. with a six inch wheel. Both



Albertson "Sioux" Horizontal Air Grinder

tools are basically horizontal grinders but can be used for wire brushing and buffing with a longer spindle.

Features include a lever momentary throttle; a throttle lock out for safety in changing wheels; light weight magnesium housings; full flow throttles with stainless steel ball valve and replaceable oil resistant rubber valve seat; screen for inlet air which is removable without unthreading; floating rotor construction, with lapped fine grain iron end plates; double row ball bearing with labyrinth seal; four precision ball bearings; power that speeds the work; excellent speed regulation and air economy; rugged shock absorber between spindle and rotor; a steel case; and comfortable hand hold.

For more data circle 86 on Postpaid Card

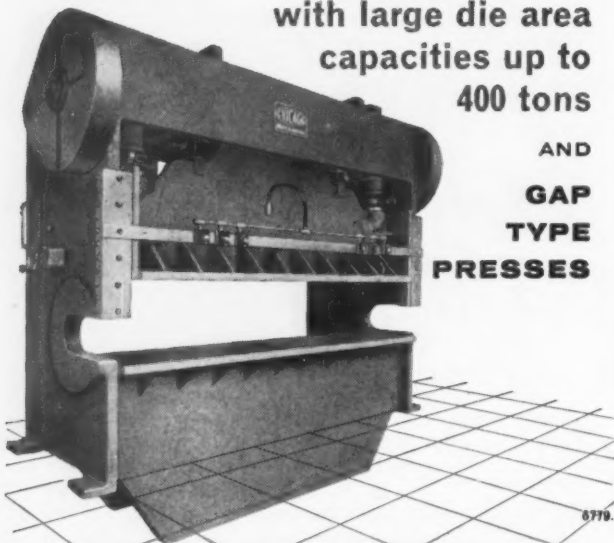


PRESSES

STRAIGHT-SIDE TYPE

with large die area
capacities up to
400 tons

AND
GAP
TYPE
PRESSES



Complete recommendations for any job on request



Press Brakes • Straight-Side-Type Presses • Press Brake Dies
Hand and Power Bending Brakes • Special Metal-Forming Machines

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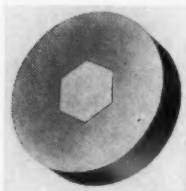
7418 South Loomis Boulevard, Chicago 36, Illinois
For more data circle 442 on Postpaid Card

SOLID CARBIDE CIRCULAR FORM TOOL BLANKS

Adamas Carbide Corporation, Kenilworth, N. J., announces the addition of solid carbide circular form tool and cut-off blanks for use on Brown and Sharpe Automatic Screw Machines to its line of carbide products. These carbide blanks have a steel plug brazed in the center. This plug is soft enough to permit drilling and tapping with conventional high speed tools, and still hard enough to prevent the deformation or stripping of the threads when the tool is clamped in position on the machine.

The blanks are furnished in two standard grades of carbide: Grade DD, which is recommended for use on all types of ferrous material and copper alloys, and Grade A, which is recommended for general use on rubber, brass, aluminum and zinc alloys.

For more data circle
B7 on Postpaid Card

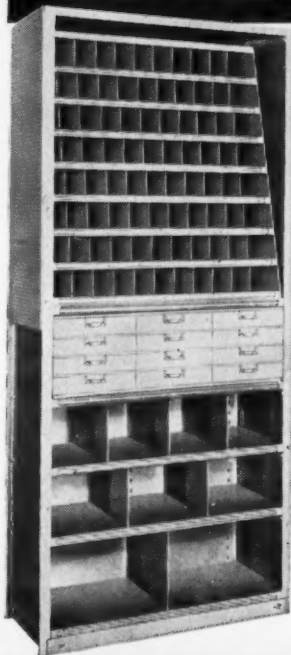


Solid Carbide Circular Tool Blank

VALVE-IN-HEAD CYLINDERS

Allenair Corp., 261 East 2nd St., Mineola, N. Y., introduces a new line of valve-in-head Tandem Cylinders, Type BVT. The units consist of a valve-in-head cylinder and a double acting cylinder mounted in line and featuring a common head at the center and two separate pistons mounted on one solid rod. The cylinders are available in bore sizes of 1½, 2, 2½, 3 and 4 inches in lengths up to 80

LYON[®] TOOL SHELVING



COMPLETE RANGE OF TOOL STORAGE UNITS MEETS EVERY REQUIREMENT

The illustration shows one of many combinations of shelving and storage inserts you can custom-build with standard Lyon units.

Shelving sections are 3' wide, 1½' deep, 7' high. Shelf dividers are adjustable every inch. No nuts, bolts or tools. Inserts include pigeon hole, sloping front, drawer case and swinging panel units. Finish, gray baked-on enamel.

Write for free
100-page Lyon Catalog.

LYON METAL PRODUCTS, INC.

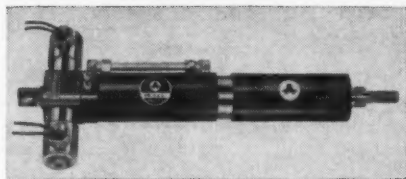
General Offices: 113 Monroe Ave., Aurora, Illinois
Factories in Aurora, Ill.—York, Pa.—Los Angeles
Dealers and Branches in All Principal Cities

For more data circle 443 on Postpaid Card

new equipment . . .

inches. A choice of mounts is offered as well as a choice of 48 different models of valve-in-head cylinders.

The rods are stainless steel and the brass, or steel, tubes are treated for corrosion. The units are intended to combine all the advantages of valve-in-head cylinders with the advantages of hydraulic control of an air operated cylinder. The hydraulic fluid can be



Type BVT Valve-In-Head Tandem Cylinder

used either in the front cylinder or in the middle section of the unit without a make-up chamber. Air speed con-

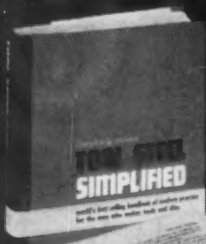
trols are provided in the valve section of the valve-in-head cylinders and hydraulic speed control is obtained by simply piping flow control valves in series with the two ports used for the hydraulic section.

For more data circle 88 on Postpaid Card

★ m m s ★

NEW INFORMATION for every tool and diemaker!

The new edition of **TOOL STEEL SIMPLIFIED** gives you proved job-help found in no other book! • Put your toolroom on a profitable, competitive basis • Reduce heat treating failures • Improve tool and die performance • Lower diemaking costs • Take the guesswork from tool steel selection • Double check your tooling procedures • Train new men faster • Get more consistent results • Advance faster in your job •



23 chapters
596 pages
349 illustrations

ORDER NOW!

PRICE ONLY \$2.50

(Postpaid in U.S.A. Elsewhere \$3)

The Carpenter Steel Company, Reading, Pa. Dept. 3

Please send the NEW Tool Steel Simplified at low price of \$2.50. Check or money order enclosed.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

(please print)

FLUX-COATED SILVER BRAZING ALLOY

A flux-coated alloy for silver brazing is announced by Eutectic Welding Alloys Corp., 40-40 172nd Street, Flushing 58, N. Y. The 1020FC alloy makes application of silver alloys convenient and fast because the need for mixing and applying a separate flux is eliminated. It can be used for

joining all types of metals in every industry, both for maintenance and production applications.

For more data circle 89 on Postpaid Card

★ modern machine shop ★

GLASS COMPARATOR SCREEN

A G Life Line, a new optical comparator screen that offers many advantages where close checking tolerances are a must, has been announced by Automation Gages, 100 Seneca Ave., Rochester, N. Y. Line quality and stability are excellent, and there is no reason ever to replace charts due to worn-out lines, according to the manufacturer.

Charts can be cleaned hundreds of times with no weakening of lines. Containing an extremely efficient light diffusing material, the chart



A G Life Line Optical Comparator Screen

permits photographic accuracy with greater visual contrast, maximum light diffusion and a minimum of surface reflection. Coating charts with lacquer or smearing with oil does not affect light diffusion.

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POWER SCRAPER

Marketed by Dapra Corp., 221 Pitkin St., East Hartford, Conn., the



New Model 660 Speeds Chamfering • Deburring • Facing • Drilling • Reaming • Tube-End Forming

- Rugged new design for high production, easy operation, faster feeds on simultaneous inside-outside deburring, chamfering, facing.
- New rigid, unitized spindle frame and heavier base retains close concentricity between the tool holder and chuck jaws.
- Simplified setup, operation, maintenance . . . one-minute speed changes with new hinged safety guard and pivoted motor mount.
- Production to 800 ends an hour . . . capacity to 2" O.D. . . air operation, larger units or special machines are also available.

Write for catalog giving cost cutting features, production data, complete specifications.



PINES ENGINEERING CO., INC.

Specialists in Tube Fabricating Machinery

644 WALNUT • AURORA, ILLINOIS

For more data circle 444 on Postpaid Card

new equipment . . .

Biax Scraper is available in two models, IV and V, for the mechanical scraping of machine beds, surface plates, and so on. Efficient scraping is possible at speeds of 1200 strokes per minute. After turning on the unit, the operator automatically follows the rhythm of the scraper, thus increasing his efficiency. Skilled handling allows the operator effortlessly and without exertion to scrape to any surface quality. Accordingly, he can concentrate more on the blued surface than is possible when scraping by hand.

One of the outstanding features of the Biax Scraper is its adjustable stroke gear which provides a stroke from 0 to 13/16 inch. This design enables the Biax Scraper to be employed to its fullest advantage. Time savings of 50 percent and more as well



View shows Biax Scraper in operation.

as top quality scraping are possible through the use of this stroke gear design.

The Biax Scraper can be used for scraping rough milled and shaped surfaces; soft and hard cast iron; malleable cast iron; investment castings; high tensile strength steel; cast steel; aluminum; brass; bronze; babbitt material; nonferrous materials; Thermite; precision milled surfaces;



Clipper Diamond Products

Clipper can offer today the most complete line in our history of diamond tools (including special applications), diamond drills and diamond wheels . . . using Natural, Man-Made or SND diamonds, with improved bonds in Resin, Metal or exclusive Ceramet (vitrified).

Literature sent on request.

CLIPPER DIAMOND TOOL CO., INC.

345 Hudson Street, New York 14, N. Y.

For more data circle 445 on Postpaid Card

small areas; interrupted surfaces; mating surfaces on gear housings; dovetails; prisms and so on. The scraper can also be used for the overhauling of machines and for grinding of molds and dies.

For more data circle 91 on Postpaid Card

★ modern machine shop ★

HOLE DRILLING GUIDE

Ames Precision Machine Works of Waltham, Mass., has introduced an accessory that may be attached to any portable drill which the company states will assure the drilling of straight holes in any direction—horizontal, vertical, angular or for counter-sinking and reaming “in line.”

The Drill-Guide is claimed

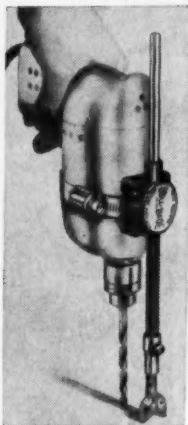
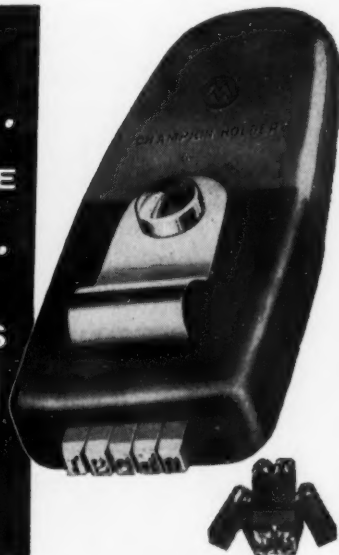


Illustration shows Ames Hole Drilling Guide in use

to remove all guesswork and assure drilling perpendicular to the work surface or at any specified angle. It can be attached in a simple manner to any portable drill, by a clamp. Once the clamp is installed, it may be left permanently on the drill, ready to receive the drill rod at any time. Two graduated dials regulate the drilling—one controls “left and right” and the other controls the “up and down” position when properly set.

For more data circle 92 on Postpaid Card

MARK IT
CLEARLY...
CHANGE TYPE
FASTER...
with
**MATTHEWS
CHAMPION**
STEEL TYPE
HOLDER



Sturdily built, perfectly balanced, the Matthews Champion Steel Type Holder insures perfectly aligned, clear cut marking. Type changes are fast and easy, with the patented Matthews spring clip assembly. Type faces are precision-engraved on highest quality alloy tool steels.

Write for Bulletin 146-A29



**MATTHEWS
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PRODUCTS**

JAS. H. MATTHEWS & CO.

3944 Forbes Ave.

Pittsburgh 13, Pa.

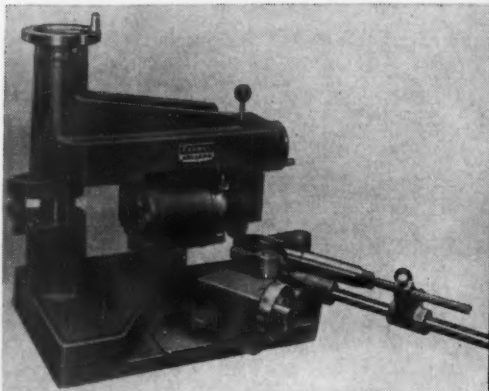
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new equipment . . .

DRILL POINT THINNING MACHINE

The Farrel-Sellers Drill Point Thinning Machine announced by Farrel-Birmingham Co., Inc., 565 Blossom Rd., Rochester, N. Y., is a compact, bench type, self contained motor driven unit. It will thin and center the points of $\frac{1}{2}$ to 3 inch diameter drills in lengths up to 24 inches. The grinding wheel is mounted on the shaft of the motor. The drill is held at three points: by hardened jaws on the leading edges of the flutes, just back of the cutting edges, and by an adjustable center at the end of the shank. This three-point grip leaves the body of the drill entirely free of any contact with the chuck.

In operation, the machine grinds a groove of the proper depth on each side of the web. This reduces the



Farrel-Sellers Drill Point Thinning Machine

length of the flat between cutting edges, which has a tendency to thicken as the drill wears. The drill is reset for each groove so that its axis is always in the same position. The grinding wheel is set with relation to



ZIEGLER FLOATING TOOL HOLDERS INCREASE TAPPING AND REAMING PRODUCTION

FAST SET-UPS — automatically compensates for misalignment up to $\frac{1}{16}$ " on dia. between machine spindle and work.

Free-Floating, Easy-To-Use Ziegler Tool Holders permit machine operators to maintain production without scrappage due to alignment inaccuracies, eliminate bell-mouthed and oversize holes and keep job set-up costs to barest minimum.

PROMPT DELIVERY

▶ **SIZES** and types to fit all machines used for tapping and reaming.



Hold positive hole location tolerances



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FOR YOUR
CATALOG
TODAY**

W.M. ZIEGLER TOOL CO.

ROLLER DRIVE FLOATING TOOL HOLDERS

**13562 Auburn
Detroit 23, Michigan**

For more data circle 447 on Postpaid Card

the axis of the drill to insure automatic concentricity of the web. Micrometer adjustment is provided for setting the grinding wheel height. Jaws for positioning drills can be opened and closed quickly. One pair of jaws hold all drill sizes within the capacity of the machine.

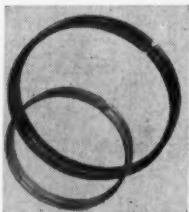
The machine occupies a bench space of 24 by 16 inches. The overall height is 24 inches. It is equipped with a 1/2 h.p. 3450 r.p.m. motor for operation on either 220/440 volt, 60 cycle, 3 phase electrical circuits or 110 volt, 60 cycle, single phase lighting circuits.

For more data circle 93 on Postpaid Card

★ m m s ★

MOTOR MOUNTING RINGS

A line of popular sized electric motor mounting rings which features a unique method of incorporating the center rib, resulting in sharper corners, has been announced by the



View shows Detroit Electric Motor Mounting Rings

Detroit Stamping Co., 350 Midland Ave., Detroit 3, Mich. The De-Sta-Co Mounting Rings are manufactured with either the "T" or "V" interlocking closures which prevent their inter-twining during storage and handling. For more data circle 94 on Postpaid Card

★ modern machine shop ★

DOUBLE-END INTERNAL GRINDER

Bryant Chucking Grinder Co., Springfield, Vt., has introduced a



**Air Operated and
Electrically Controlled
HOT STAMPING MACHINE**

Ram pressure from several ounces to 1200 pounds squeeze.
Temperature control to 600°F.
Time dwell controls from fraction of a second to several minutes.
Micro or foot switch actuation.
Stamping head may be raised or lowered on the column.
Fail Feed is automatic and adjustable.
Dial feed shown is optional.



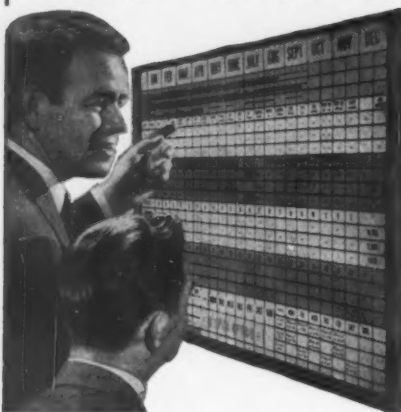
MODEL SRS-B
Weight 150 pounds.
Dimensions:
20" tall,
15" wide,
18" deep



DEFIANCE
MACHINE & TOOL COMPANY
1920 S. VANDEVENTER Dept. MM ST. LOUIS 10, MO

For more data circle 448 on Postpaid Card

You Get Things Done With Boardmaster Visual Control



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200 MODERN MACHINE SHOP

new equipment . . .

double-end internal grinder. The machine is specifically designed for grinding both a straight and a tapered bore at a single chucking of a workpiece. Two opposed wheel slides and a rotary indexing worktable carrying two workheads permit two workparts to be ground simultaneously.

A rotary indexing worktable, supporting two workheads, is centered between straight bore and taper bore grinding units. These units may be operated simultaneously or individually, as desired. Machine operation is completely automatic. The operator needs only to load and unload the machine.

Important high production features of the new grinder include automatic wheel dress cycling; compound axial and angular slide permitting reciprocal grinding of the tapered bore; and diamond sizing for both straight and taper bore grinding.

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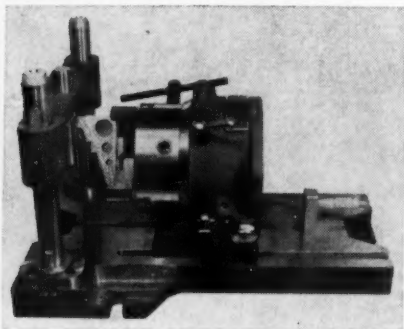
View of Bryant Double-End Internal Grinder

June, 1961

HORIZONTAL-DRILLING ATTACHMENT AND MASTER-SPACER UNIT

A new horizontal drilling and master spacer unit for rotary positioning work with great precision has been announced by Erickson Tool Co., 34350 Solon Rd., Solon, Ohio. The rugged multi-index spacer is teamed with a drilling device which can be set to Jo-block accuracy. The unit assures repeat indexing within low tenths—radial accuracy of 0.001 inch cumulative error on a 6 inch diameter circle. Location of holes being machined in relation to the part can be held to plus or minus 0.0005 inch or closer. The unit can be set up with a planer gage, micrometer, or gage blocks. The master spacer and horizontal drilling unit is ideal for toolroom or production machining. The unit retains highest accuracy under the torque of heavy drilling or boring cuts, interrupted cutting, and side thrusts.

The Erickson Master Spacer features completely sealed tapered-roller bearings for highest indexing accuracy. The floating brake shoes lock the spacer spindle without affecting spindle alignment. A three-jaw 6 inch precision chuck centers and holds the work firmly. A hardened index wedge-



View shows Erickson Horizontal Drilling Attachment and Master-Spacer Unit

June, 1961

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STAMP**

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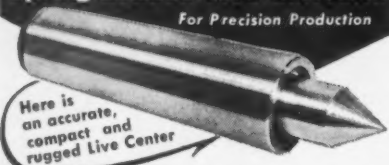
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MODERN MACHINE SHOP 201

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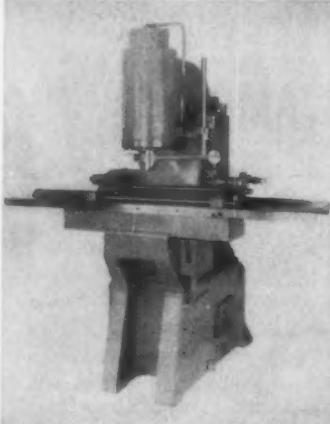
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New 15-Ton Straightening Press Model #S-15-D-E with spring centers. One handle to control ram and pressure exerted. Hydraulics and electrics are inter-connected.

See your Dealer or write for Catalog M-44

Greenard ARBOR PRESS CO.

41 CROWN ST. WAGNUA, N.H.

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202 MODERN MACHINE SHOP

new equipment . . .

plunger locates the precision hardened and ground 24 position index plate. With the Master Spacer-drilling attachment unit, drilling, reaming, boring, counterboring, and so on, can be done on the side of any cylindrical workpiece. First the bushing in the attachment is aligned with the machine spindle. Then the spacer is positioned accurately with respect to the bushing and locked in place. The spacer is located from a diameter-setting plug which accurately fits the bushing.

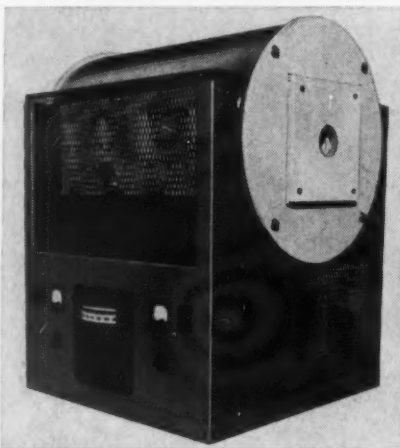
A vertical drilling attachment is also available for locating holes with the same accuracy on the end of the workpiece.

For more data circle 96 on Postpaid Card

★ modern machine shop ★

ELECTRIC COMBUSTION TUBE FURNACE

An electric combustion tube furnace incorporating a new type of power control has been announced by Despatch Oven Co., 619 South East



Despatch Electric Combustion Tube Furnace

June, 1961

Eighth St., Minneapolis 14, Minn. The tube furnace, which produces 2600 degrees F. maximum, is the Despatch Model SC-32. It provides a twelve-inch uniform heat zone in a 2½-inch o.d. ceramic tube, and is rated at 7 kw. on 220/1/60 vac.

The power control, called Thermionik Power System, uses thyatron electronic tubes. The thyatrons replace conventional contactors and saturable reactors, and are said to allow greater accuracy of temperature control.

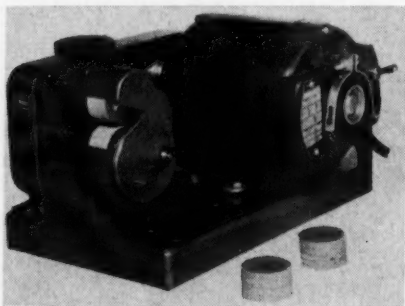
Use of the electronic tubes, with resultant savings in space, weight and initial cost, has been made practical through development of a stable plug-in grid-biasing unit, according to the manufacturer. The Thermionik Power System is usable with any d. c. producing or proportioning slide wire control system, or may be operated manually.

The Despatch Model SC-32 is available with automatic indicating-type controls and mounts for customer-specified two to four-inch o.d. tubes. It is also available as a muffle-type. For more data circle 97 on Postpaid Card

★ modern machine shop ★

HIGH SPEED WIRE STRIPPER

The WR-6 Wire Stripper, introduced by High Speed Hammer Co.,



High Speed Hammer WR-6 Wire Stripper

June, 1961

ANYTHING NEW IN DIAMOND WHEELS?

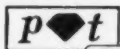


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You can grind small diameter holes in hardened, heat sensitive steels, carbide, ceramic, ferro-ceramic material, and glass. Shanks are hardened and ground accurately. Diamonds are mounted under controlled atmospheric conditions by a patented new electronic method, assuring their maximum retention. The sharpest edges of the diamonds protrude for rapid stock removal. Widely used on jig and internal precision grinding. Available in a complete range of sizes from .018 inch to .750 inch in diameter.

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PRECISION DIAMOND TOOL CO.



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MODERN MACHINE SHOP 203

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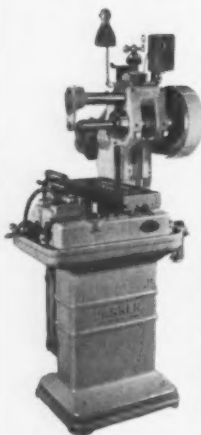
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This installation affords a 9½" Table Travel with a fast work approach and return.

Write for details

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Division, THE F. HOHLFELDER CO.

26470 Lakeland Blvd. • Cleveland 32, Ohio

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204 MODERN MACHINE SHOP

new equipment . . .

313 Norton St., Rochester, N. Y., has been specifically designed for resistance and magnet work and similar applications. Of unique design, employing a minimum number of moving parts, this precision made wire stripper is a rugged tool requiring little bench space. It is 8 inches wide by 10 inches deep by 6 inches high with a net weight of only 15 lb. Two abrasive wheels instantly remove the wire coating with no damage to the conductor. Various density wheels are available to meet each and every requirement.

Specifications include a capacity of No. 32 through 50 A.W.G. wire. Mandrels are ¼ inch diameter by ¾ inch face.

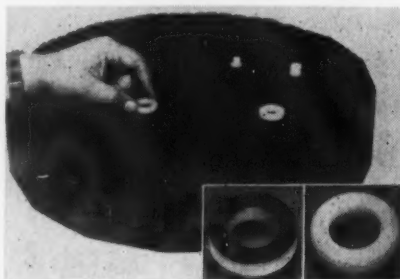
Motor specifications are 1725 r.p.m., 115 V., 1 Ph. 60 cy. The unit is furnished complete with cord, plug and cord switch.

For more data circle 98 on Postpaid Card

★ modern machine shop ★

NONCONTAMINATING BLACK GRANITE LAPPING PLATE

A noncontaminating black granite hand lapping plate that produces fine finishes on Teflon, nylon and other nonferrous materials has been announced by The DoAll Co., Des Plaines, Ill. The lapping plates are



View of DoAll Black Granite Lapping Plate

June, 1961

12 and 18 inches in diameter and 3 inches thick. The lapping surfaces are grooved with $\frac{1}{8}$ inch deep serrations spaced $\frac{1}{2}$ inch apart. The advantages of a noncontaminating lapping plate are threefold: finer surface finish, better appearance and elimination of the danger of a contaminator causing malfunctioning of the lapped part. For more data circle 99 on Postpaid Card

★ modern machine shop ★

PNEUMATIC PRESS

Howard International, Inc., 350 Fifth Ave., New York 1, N. Y., has introduced a pneumatic press, the PH-3, for distortion-free, breakage free, accurate assembly and working of small metal parts.

The speeds of the up and down strokes of the PH-3 are independently controlled, delivering with chronometer accuracy a powerful yet delicate action which squeezes the work without any impact. This eliminates distortion and breakage, and the workpieces are produced with a precision that will meet rigid requirements.

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View of Howard LIP Model PH-3 Air Press

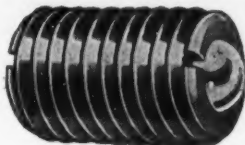
June, 1961

REID

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Suitable for locating or positioning in dies, special tooling, automatic feed devices, etc., where controlled end pressure is required. Supplied in many sizes with various end pressures. Balls are made of type 440 stainless steel to prevent rust and corrosion. SPRING PLUNGERS also available.

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BEAVER FALLS • PENNSYLVANIA
Plants: Beaver Falls, Pa.; Hammond, Ind.

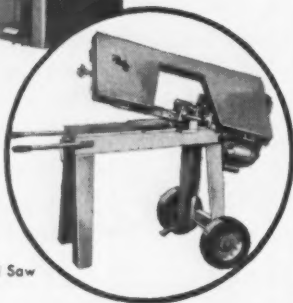
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MODERN MACHINE SHOP 205



Model 2600
Contour Saw

TWO NEW PEERLESS SAWS



Model 610
Carbon Blade Band Saw

● The Model 2600 includes all the engineering know-how gained by almost a half century of Peerless experience in the metal sawing industry . . . throat capacity 26", height 15", adjustable table.

The Model 610 brings new versatility to your shop . . . completely mobile . . . capacity 6" x 10" . . . adjustable vise, saw guides and pressure control . . . ideal for general maintenance work.



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PEERLESS MACHINE CO.
Racine, Wisconsin

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206 MODERN MACHINE SHOP

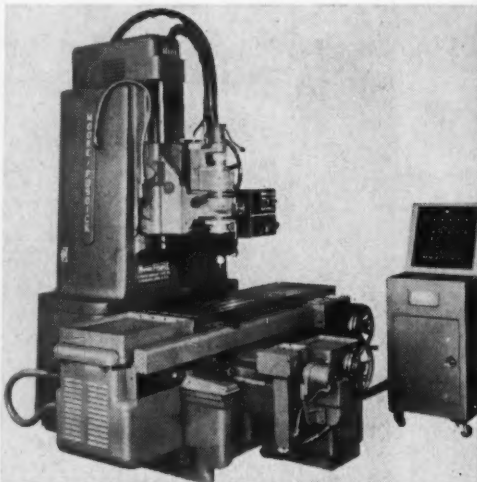
new equipment . . .

REMOTE CONTROL

Fosdick Machine Tool Co., Cincinnati 23, Ohio, has introduced the Fosmatic Preselect Control. The control is housed in a separate console, displaying on its face a series of numerical dials. While a machining operation is being performed, the operator sets the coordinates of the next operation on these dials. The machine will move to the new location at the touch of a button as soon as the previous operation is finished. This is basic numerical control, with the substitution of manual input for tape input. Otherwise, the control is similar to tape control. In fact, the Preselect Control console is completely interchangeable with the Fosmatic Numerical Control console (which offers both tape and manual input).

The controlled machines must, of course, be equipped for remote numerical input.

For more data circle 101 on Postpaid Card



View of Fosmatic Preselect Control shown accompanying a Moore-Fosdick Jig Grinder

June, 1961

PROCESS INCREASES TOOL STRENGTH AND RESISTANCE

Temp-Lok Corp., Box 683, Huntington, Ind., announces the Temp-Lok Process, a method of increasing the strength and wear resistance of high speed steel cutting tools and die steels which is accomplished by reorientation of the atoms in the crystal. Reorientation of the atoms, by the Temp-Lok Process, increases the bond energy of the atoms. The total amount of energy, required to bring about failure of the crystal structure of the metal, increases as the bond energy, or enthalpy is increased. It is by this mechanism that the total effective life of the tool is said to be greatly increased.

The Temp-Lok Process is non-destructive and may be safely used on completely finished tools. A four-page brochure available from the company contains full details on the process, including how it is applied.

For more data circle 102
on Reader Service Card

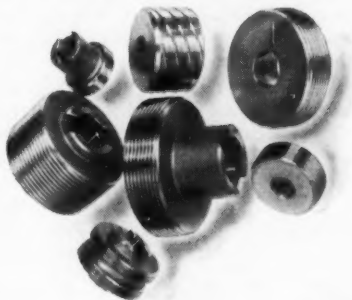
★ m m s ★

NUTRUNNERS AND SCREWDRIVERS

Buckeye Tools Corp.,
P. O. Box 966, Dayton
1, Ohio, announces that



More Can Be Done



With Reed Thread Rolls!

Take full advantage of the possibilities illustrated above which thread and form rolling offer to reduce costs and improve quality. Thread rolling also can eliminate many secondary operations.

Reed, pioneer-leader in the development of all types of thread rolling equipment, supplies thread and form rolls for a wide variety of applications.

Reed Thread Rolls manufactured under rigid standards of quality control are uniform . . . durable . . . accurate, and available for all types and makes of holders. Over 150 standard sizes regularly stocked . . . plus non-standard rolls on special order.

REED

ROLLED THREAD DIE CO.

Subsidiary of Union Twist Drill Company

HOLDEN, MASSACHUSETTS

Specialists in Thread and Form Rolling Tools and Equipment

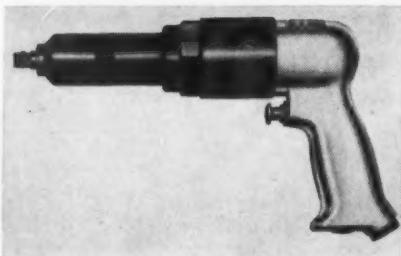
For more data circle 459 on Postpaid Card

new equipment . . .

its 41F Series of air-powered, pistol grip screwdrivers and nutrunners has been enlarged by the addition of two models equipped with a torque control clutch. This clutch is adjustable for any desired torque from 5 to 100 inch-pounds. Clutch jaws automatically disengage when a preset torque is reached, and as soon as the tool is released from the work the clutch automatically sets itself for the next fastener.

The nutrunner model 41F-174 has a $\frac{3}{8}$ inch square drive front end; as a screwdriver 41F-134, the tool has a $\frac{1}{4}$ inch female hex spindle.

Before the introduction of these two models, Buckeye had met the application requirements with its 31F Series. The 41F Series, however, houses an air motor rated 50 percent more powerful and drives the clutch at a free speed of 1,500 r.p.m. The larger motor puts maximum authority be-



Buckeye 41F Series Air-Powered Tool

hind the clutch to minimize speed variation in driving for greater torque control and fastening accuracy.

Speed can be externally regulated by a sensitive trigger throttle that permits slow tool start-up and gradual speed increases. "Quietool" construction allows operation at all speeds with minimum tool noise.

Weighing less than 5 lbs., these balanced tools have an overall length of 10 13/16 inches. Drive offset is 1

RIVETERS . . .

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and
PACEMAKERS
in their
line**




—head rivets from smallest to $\frac{3}{4}$ " diameter cold steel, either by NOISELESS SPINNING or VIBRATING HAMMER method—fast, economically—types include Vertical and Horizontal Spindles, foot-power or automatic.

Free estimates of your work.
Write for catalog today.

THE GRANT MFG. & MACHINE CO.
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208 MODERN MACHINE SHOP

The STEVENS Line SINCE 1925

Introducing NEW series



15" ROTARY
TABLE—STD.

ROTARY TABLES _____ 5-8-12-15-18-24"
sizes both standard and dial indexing types
ADJUSTABLE TILTING TABLES _____ #0-1-2
COMPOUND TABLES _____ #1-1½-2
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INDEX CENTERS—multiple spindle
SPECIAL MACHINES—designed and built

See your dealer or write for bulletins

The John B. Stevens Company

Main Street, Somersville, Conn., U. S. A.

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June, 1961

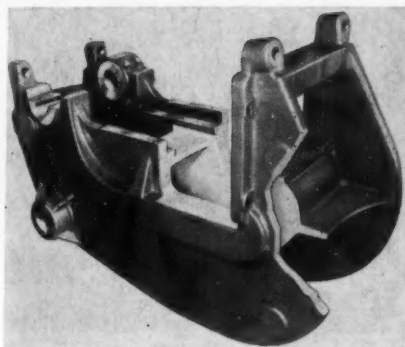
inch. Other features include an adjustable exhaust deflector, packaged and removable valve assembly, built-in oiler, and husky planetary gearing which may be externally lubricated quickly and easily without disassembling the tool.

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★ modern machine shop ★

CAST IRON FRAMES FOR ENTIRE PRESS LINE

The Federal Press Co., Elkhart, Ind., announced it has converted to Meehanite cast iron frames on all of its presses. High tensile strength, machine-tool grade, Meehanite cast iron was selected for its high compressive strength, its vibration dampening qualities, and its ability to withstand deflection from overload without permanent deformation. These quali-

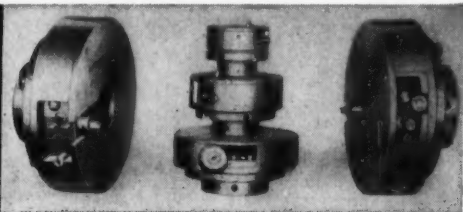


Federal Press Meehanite Cast Iron Frame

ties and the proper distribution of the metal in the Federal one-piece frames assure maximum rigidity under capacity loading conditions, according to the company.

The columns of the new frames are reinforced on both the inside and the

MUMMERT-DIXON FACING HEADS



**IMPROVE
FACING OPERATIONS**
On Boring Mills,
Drills, Lathes, Millers
And Radials

One-way and two-way automatic tool feed. Bit travels radially from center outward or reverse. 10 sizes, 6" to 46" dia. Also combination hydraulic Boring and Facing Heads, and "Bulldog" Boring Heads.



PEERLESS Tools for Motor Repair Shops

Self-Contained Gear-Driven Radial Grinders

Swing Frame Grinders

Oil Stone Grinders

MUMMERT-DIXON COMPANY

126 Philadelphia St.,

Hanover, Penna.

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New \$300 precision cut-off saw paid for itself in 15 minutes

Navkut*, the new precision cut-off saw, cut production costs of "spacers" substantially at Unicorn Engineering Inc. (now owned by Computer Measurements Co., Sylmar, Calif.) The cost of spacers was reduced from \$8 to 80¢ each by Navkut's simple cut-off operation. During every 15-minute production run, the Navkut saw paid for itself. Such results aren't unusual with Navkut, the saw that can cut parallel tolerances to within .002" in ferrous, non-ferrous, wood, and plastic materials with only two types of blades. Usually the cut finish and accuracy will be so precise there is no need for milling or grinding. All this, yet the Navkut saw costs only \$300. See for yourself how it can save you money. Write today for a free 15-minute demonstration in your shop.

*TRADEMARK

Navkut saw is another product marketed by:



NAVAN PRODUCTS INC.

Subsidiary of
North American Aviation, Inc.
900/1 North Sepulveda
El Segundo, California

new equipment . . .

outside, from below the bolster, up beyond the bearing area. A cross member ties the columns together at the top of the frame and supports the bearings against deflection that could otherwise cause spreading and misalignment.

Vertically split bearing caps rest in the reinforced frame and permit the transmission of shock, from both the thrust and return strokes, directly to the frame. If the ram should ever become jammed, the bearings may be loosened and the pressure relieved by permitting the removal of the crankshaft from the bearing.

For more data circle 104 on Postpaid Card

★ modern machine shop ★

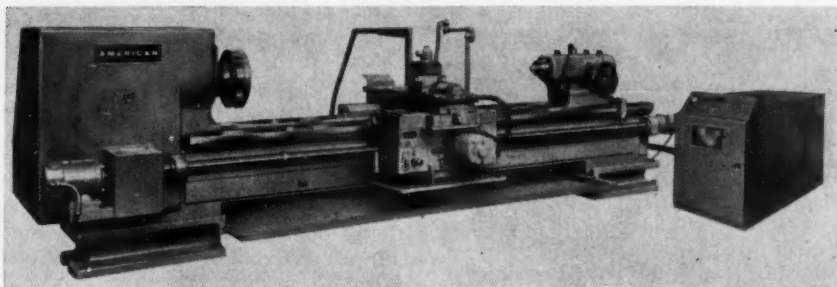
TAPE CONTROLLED ENGINE LATHE

American Tool Works Co., Pearl St. at Eggleston Ave., Cincinnati 2, Ohio, has introduced an engine lathe, especially designed and built for continuous path tape control, in sizes 2010, 2413, 2514 and 3019. Each size is controlled by a General Electric Mark Century continuous path control system, using 1 inch, 8-channel punched tape.

Newly designed from the ground up, this heavy duty lathe is designed to handle all roughing as well as finishing on any turning, boring and facing operations. The 2010 and 2413 have 2-speed heads with a total speed range, in conjunction with their 16-to-1 motors, of 25 to 1800 r.p.m. through 30 taped changed. Maximum motor size is 30 h.p. The swing over the carriage wings for the 2010 is 21 inches, and swing over the carriage bridge and tool block is 10 inches. The 2413 swings 24 inches over the carriage wings and 13 inches over the carriage bridge and tool block.

The 2514 and 3019 also have 2-speed

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View shows American Tool Engine Lathe with continuous path tape control

heads with a total speed range, in conjunction with 16-to-1 motors, of 16½ to 1200 r.p.m. through 30 taped changes. The maximum motor size is 50 h.p. The 2514 swings 25½ inches over the carriage wings and 14 inches over the carriage bridge and tool block. The 3019 has 31 inch swing over the carriage wings, and the swing over the carriage bridge and tool block is 19 inches. In all cases the

main drive motor is mounted at the rear of the head and connected directly to the initial drive shaft by a positive drive multiple V-belt.

For more data circle 105 on Postpaid Card

★ modern machine shop ★

DRILLING MACHINE

Buffalo Forge Company, Buffalo, N. Y., has announced an RPMster

.000,020"

(TWENTY MILLIONTHS)

GUARANTEED ACCURACY

VEE-ARC

SUPER-PRECISION

**LIVE
CENTERS**



Specifically
designed
for

**ULTRA-
PRECISION
TURNING AND
GRINDING OPERATIONS**

UNIQUE FEATURES

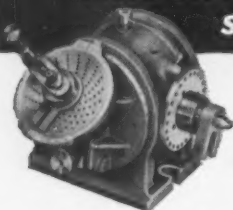
- Extended nose spindle . . . carbide tipped
- Life-time lubricated, pre-loaded ABEC-7 ball bearings
- Spring compensation to .020" axial movement without impairing accuracy
- Heat treated, stainless steel construction
- Hexagonal anti-roll shoulder

Vee-Arc Super-Precision
Live Centers are also
**AVAILABLE THROUGH YOUR
MONARCH AND CINCINNATI
LATHE DISTRIBUTORS**

WRITE FOR BULLETIN 1282A DIRECT TO
VEE-ARC CORPORATION, DEPT. MM, WESTBORO, MASS., U.S.A.

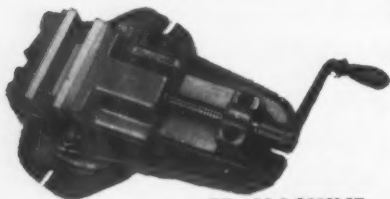
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**TOOLROOM ACCURACY
PRODUCTION LINE
STAMINA**



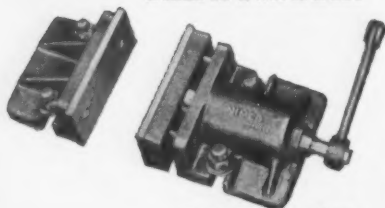
**DIVIDING
HEADS**

Plain or Double Swivel with tailstock. 6½", 8" or 10" Swing. (8" and 10" sizes have exclusive floating index plate).



**5" MACHINE
VISE**

Plain or Swivel Base



**QUICK-CLAMP
MIL-VISE**

Jaw Width — 6" or 8"
Jaw Opening — Unlimited

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TOOLS

Write for detailed literature.

Nichols Morris Corp.

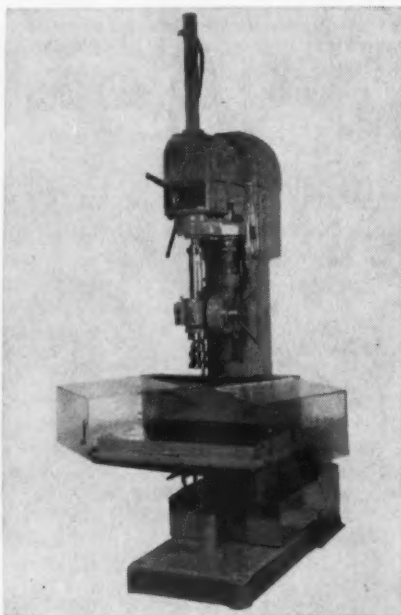
76-H Mamaroneck Ave.
White Plains, N. Y.

new equipment . . .

Drilling Machine with special hollow spindles to do drilling jobs in super-hard "exotic" materials. This unique drilling machine features, in addition to the hollow spindle, a transfer attachment for introduction of coolant under pressure, variable feeds, higher speeds and coolant pumps to deliver adequate coolant pressure.

The Buffalo Hollow Spindle RPMster is being used successfully to drill such super-hard metals as titanium, stellite, rene 41 and stainless steel. It also quickly and cleanly drills some of the hardest new ceramic materials. The Buffalo RPMster in three sizes, as well as the No. 18 and No. 22 Drilling Machines, are all available with the special hollow spindle.

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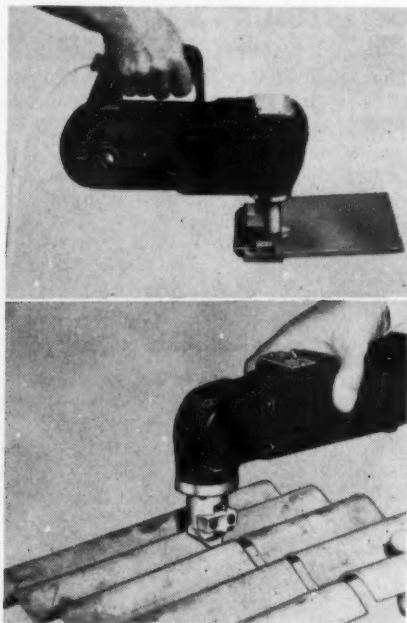
View of Buffalo Hollow Spindle RPMster

For more data circle 465 on Postpaid Card

AIR AND ELECTRIC- POWERED PORTABLE NIBBLERS

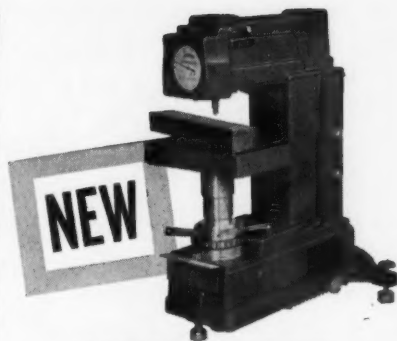
A line of Fenway nibblers manufactured by the Fenway Machine Co., Inc., 1910 North Marshall St., Philadelphia, Pa., are portable nibblers which operate on a unique punch and die principle. The special design and cutting action permits cutting of ferrous and non-ferrous metals without distortion. This feature also applies to one of the newest Fenway Nibblers which cuts corrugated steel through a simple adjustment of its cutting head. Each model cuts sharply and cleanly, and edges are so smooth that they do not require finishing, such as deburring, grinding or buffing.

In areas where safety is of utmost importance, the line of Fenway Air-Powered Nibblers proves exceptionally suited for applications in oil re-



Fenway Air and Electric Portable Nibblers

June, 1961



KENTRALL Hardness Testers Are Motorized

By removing major test loads automatically, the new motorized Kentralls reduce operator error, increase reproducibility of test results, and raise the productive capacity of the machine—for the same price as hand operated testers.

The motorized Kentralls are available in Combination Testers which provide both Regular and Superficial Rockwell Hardness Testing in a single machine. For those applications that do not require the additional range, Kentrall also makes single purpose testers for either Regular or Superficial testing alone.

**For complete information write
for Bulletin CRS-60.**

KENTRALL
THE TORSION BALANCE COMPANY
Main Office and Factory:
CLIFTON, NEW JERSEY

Sales Offices: Chi., Ill.; San Mateo, Cal.
TB-164

For more data circle 466 on Postpaid Card
MODERN MACHINE SHOP 213

ELDORADO*

HAS OVER 1001
GUN DRILLS IN STOCK



NOW AVAILABLE FROM STOCK
ALL SOLID CARBIDE TIPPED
Drills in every 1/64" increment

Size Dia.	Length	Driver
1/250" to 5/1000"	10", 16", 22"—all diam. 28", 36"—most diam.	3/4" x 2 1/4"
5/16" to 7/500"	16", 22", 36"	1" x 2 1/4"
7/56" to 1.0000"	22", 36"	1 1/4" x 2 1/4"

IMMEDIATE SHIPMENT
Also custom made Gun Drills in all diam.
up to 2" in any length within dia. limits.
—ON NORMAL DELIVERY
ELDORADO - MILFORD

...there's ONE to LOWER YOUR HOLE COSTS!

ELDORADO'S constant inventory of popular size GUN DRILLS is keyed to the needs of the industry, designed to the most exacting specifications! Made to produce economically, straight, round, accurately located, finely finished holes... FASTER, in One Single Operation.

Our years of accumulated GUN DRILL making experience and knowledge, plus a complete research and engineering department are yours to take advantage of.

Get these important benefits with ELDORADO

- The world's largest manufacturer of GUN DRILLS—exclusively.
- A complete choice of sizes, lengths, types.
- Eliminate secondary operations—reaming, honing, grinding.
- Save your company money by reducing "cost-per-hole."
- Drill most materials—aluminum, cast iron, brass, tool steel, stainless, etc.
- Drill any shaped part to any depth (sometimes interrupted holes or across existing holes).
- Drill shallow or deep holes to precision tolerances.

Since these extras cost you no more... your best bet is an ELDORADO GUN DRILL

ELDORADO specialized engineers, backed by research facilities are available to assist you on special "HOLE" problems. WRITE TODAY!



Specializing 100% in Gun Drills and Related Tools.

ELDORADO TOOL & mtg. corp.

364 BOSTON POST ROAD • MILFORD, CONN.

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214 MODERN MACHINE SHOP

new equipment...

fineries, chemical plants and other areas where a torch or an electric tool is restricted.

Operator safety is also provided because of the unique cutting action—cut material is not hurled upwards or at a tangent, the pieces fall directly beneath the work. This eliminates the possibility of eye or face injury. In addition, design of the cutting head eliminates the chance of an operator's fingers coming in contact with the punch.

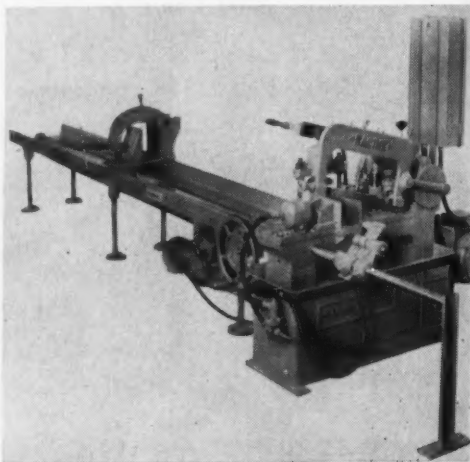
Light, medium, heavy and extra-heavy duty models are available for cutting materials up to 1/4 inch steel and 5/16 inch aluminum. Inside circles, squares and odd-shaped holes can also be cut quickly and easily.

For more data circle 107 on Postpaid Card

★ modern machine shop ★

METAL CUTTING MACHINES

Racine Hydraulics & Machinery, Inc., 2000 Albert Street, Racine, Wisconsin, has introduced the Models 66W2A (two speed) and 66W4A



Racine Model 66W2A Metal Cutting Machine

June, 1961

(four speed) in a line of stock feed small automatic metal cutting machines. These automatic saws combine hydraulics, electricity and pneumatics in a simplified form for exceptional efficiency in toolroom or production plant. They will cut all ferrous and non-ferrous metals at speeds up to 140 five-inch strokes per minute and have a capacity of 6 inches by 6 inches, actual 6 $\frac{1}{8}$ inch diameter.

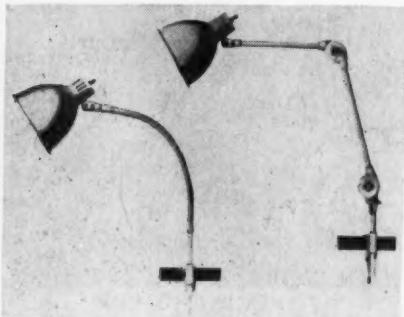
The rugged length gauge incorporates a fine micrometer screw adjustment that can be set quickly to hold lengths within 0.005 inches. Minimum quantities of five or 10 pieces as well as much greater quantities can be cut automatically at operating savings because of the short set-up time. An accurately controlled hydraulic blade feed insures fast, straight cuts, and the work is held firmly by air chucks employing low air consumption.

For more data circle 108 on Postpaid Card

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SWING LAMPS

Swing-O-Lite, Inc., 13 Moonachie Rd., Hackensack, N. J., announces two swing lamps with 15 and 24-inch arm reach, for jobs where direct bright light in variable positions is required. The lamps have three types



View shows (Left) Swing-O-Lite Gooseneck Lamp and (Right) Balanced Swing Lamp.

June, 1961

504 Ways to Lick
Tough Finishing Problems

Paramount FELT BOBS

18 sizes, seven shapes, four degrees of hardness — a total of 504 Paramount Felt Bobs always ready to solve your most difficult precision finishing problems. Available with mandrels or unmounted. Finest quality wool felt.

Put a Paramount Bob on the Job

- For polishing surfaces that must be held to close tolerances.
- For buffing or lapping hard-to-reach spots.
- For de-burring and touching up.
- For close-quarter precision finishing on all metal surfaces.

Get better finishes for less cost — "Put a bob on the job." See your Paramount jobber or write for literature. Ask about K-1 and K-2 Bob Assortment Kits that cost far less than buying bobs separately.

K-1 contains 66 pieces \$10.95
K-2 (K-1 plus 4 compound sticks) \$12.95

Bacon Felt Company
11 Fifth Street
Taunton, Massachusetts

For more data circle 468 on Postpaid Card

MODERN MACHINE SHOP 215

new equipment . . .

of mountings—permanent, clamp and wall—so that they can be placed wherever they are needed.

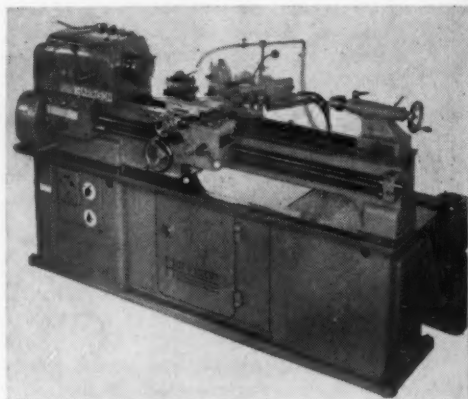
The 15-inch lamp has an all direction gooseneck stem, but the 24-inch lamp is equipped with a custom engineered directional arm with adjustable knobs for perfect tension. Both lamps cover a wide lighting area and use 75 watt bulbs.

For more data circle 109 on Postpaid Card

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TOOLROOM AND COPYING LATHE

In conjunction with its appointment as national sales representatives for Harrison Lathes, REM Sales, Inc., a subsidiary of the Robert E. Morris Co., 5004 Farmington Ave., West Hartford 7, Conn., has announced the availability of a 12-inch combination



Combination Tool Room and Copying Lathe

toolroom and copying lathe. The optional tracing, or copying, unit is built into the rear of the machine so that normal lathe operation is completely unrestricted at all times. Thus, it is possible to turn the required template,

A JOB THAT ONLY A —

Leitz TOOLMAKER'S MICROSCOPE

CAN DO!

- Permits measurements in 2 dimensions plus checking of Radii, Concentric Circles, threads and angles.
- Has exclusive intermediate image system which combines coordinate measuring microscope and optical comparator in one instrument.
- Built-in charts permit use in three magnifications.
- Reads to .0001" or to .00005" from Master glass scales in larger models.
- Available in 1" x 2", 1" x 4", 2.3" x 6", 6" x 6" and 8" x 40" capacity.

FREE BOOKLET—Write for new catalog.

OPTO-METRIC TOOLS, INC.
137MM VARICK STREET, NEW YORK 13, N.Y.

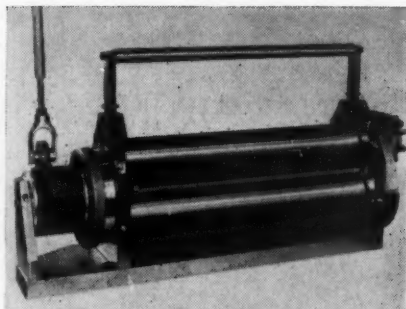
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and then lock in the copying unit for immediate quantity reproduction of the part.

The lathe is available in two models, with either 24 or 40 inches between centers, which deliver a wide range of turning speeds up to 2000 r.p.m. A unique feature is that end train gearing is totally enclosed and operates in an oil bath. This not only prolongs gear life, but also lowers the noise level.

For more data circle 110 on Postpaid Card

★ modern machine shop ★



View of 15 inch Roll Feed Series 9 PRF

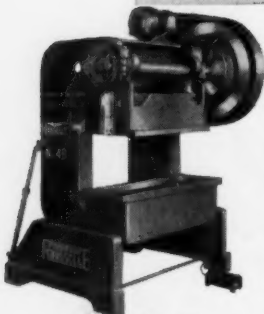
PRECISION ROLL FEED

Benchmaster Manufacturing Co., 1835 W. Rosecrans Ave., Gardena, Calif., introduced its Series 9 PRF precision roll feed with roller lengths suitable for 15 inch stock widths. The

Series 9 PRF has an adjustable stroke of 0 to 9 inches. The exceptional stroke length is obtained with a set of fully enclosed gears.

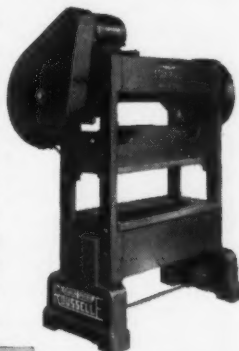
The Series 9 PRF roll feed is reversible and incorporates Benchmas-

High-Output with **ROUSSELLE** DOUBLE-CRANK PRESSES



No. 4B OBI with "Econo-Air" clutch.

SPEED UP PRODUCTION with these versatile 40-ton presses. Large bed and ram areas make them ideally suited to handle wide rolls or sheets . . . do multiple punching, steel-rule die work and other high output operations. For rapid, shockless starting and stopping, presses can be equipped with electrically controlled "Econo-Air" friction clutch . . . Ask for new catalog.



Choice of over 30 models and types in 5 to 60-ton sizes



STRAIGHT SIDE—Die space up to 24 in.; bed space up to 6 ft. between uprights.

SERVICE MACHINE COMPANY

Mfrs. of Rousselle Presses

2310 WEST 78TH STREET • CHICAGO 20, ILLINOIS

For more data circle 470 on Postpaid Card

Rousselle Presses are sold exclusively through Leading Machinery Dealers.

RAISE GRINDING PRODUCTION



FOR \$2.70



A typical Desmond Huntington grinding wheel dresser costs about \$2.70 from your distributor, yet it substantially increases grinding production, makes wheels cut better, and lowers grinding costs. By dressing all your grinding wheels regularly you remove inefficient dull particles and loaded metal, expose a fresh new grinding surface. Your Desmond distributor can furnish the exact model you require. Ask his advice.

*The only complete line of
grinding wheel dressers and cutters*

Desmond

The Desmond-Stephan Mfg. Co.
Urbana, Ohio

For more data circle 471 on Postpaid Card

new equipment . . .

ter's roller cam clutch in double width. This clutch provides exceptional repeat accuracy and freedom from wear. To provide ample contact area, brake is doubled in width. The brake design permits adjustment during operation to apply correct resistance for feeding accuracy and smooth performance.

Bottom feed roller is $3\frac{7}{8}$ inches in diameter and is completely hollow to reduce inertial lag and momentum, thus permitting operating speeds up to 200 s.p.m. Heavy roll pressure is maintained by spring load, insuring positive, non-slip feeding. Roll lifters are actuated by the roller bar across the top.

For more data circle 111 on Postpaid Card

★ modern machine shop ★

DRAWER OVENS

Blue M Electric Co., 138th and Chatham St., Blue Island, Ill., has announced a line of five drawer mechanical convection horizontal airflow ovens with Power-O-Matic 60 satur-



View shows Blue M's Five Drawer Mechanical Convection Horizontal Airflow Oven

able power reactor control and Range-Lock protection. The ovens are available in two temperature ranges of 100 to 356 degrees F. and 100 to 600 degrees. F.

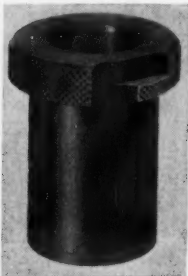
Designed for the multiple production of piece parts of steel, rubber and plastic, including parts requiring aging, drying, preheating, curing and baking, each oven features heavy gauge steel construction with structural angle reinforced housing. Each oven has triple side walls and is finished in a silicone base aluminum paint on the interior. The exterior is finished in an attractive silver Hammerloid enamel.

For more data circle 112 on Postpaid Card

★ m m s ★

DRILL BUSHINGS

The addition of a complete line of tungsten carbide drill bushings has been announced by American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 58, Calif.



American Drill Bushing

The new bushings are claimed to have approximately 50 times the wear life of ordinary steel bushings. Several types are available, including head and headless press fit, fixed and slip renewable.

For more data circle 113 on Postpaid Card

★ modern machine shop ★

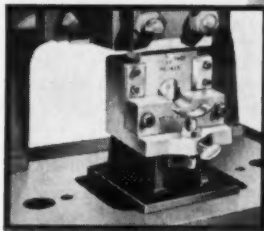
TILT-SWIVEL VISE CLAMP

Engis Equipment Co., 431 South Dearborn St., Chicago, Ill., has de-

NOTCH 12 PIPE ENDS per MINUTE with ARC-FIT®



Mounted in hand press with portable stand.



Complete unit with adapter mounted in punch press.

ARC-FIT notching makes perfect joints for welding or brazing.

The Arc-Fit cuts clean contours for "T" joints in seconds ... without deformation ... no finishing is required. Mounted in hand or power press it readily notches 12 pipe ends per minute ... 750 per hour.

A standard Arc-Fit with easily interchangeable dies (one for each contour) notches pipe ranging up to 2" O.D.; or tubing up to 2 1/2" O.D. Special Arc-Fits are available for larger sizes, angles other than 90°, slotting, notching square pipe and for angle iron or flat stock.



Ask for literature. For quotation send sample or drawing of part.

VOGEL TOOL & DIE CORPORATION

1823 North 32nd Avenue, Stone Park, Illinois

For more data circle 472 on Postpaid Card

Pipe, tubing and shapes notched with Arc-Fit units.



New! \$15*
ONLY...

**BUYS THIS COMPACT
MIST COOLANT UNIT**



***Complete With
Magnetic Nozzle
Holder As Shown**
(In U.S.A.)

Especially designed for small precision machinery used for drilling, tapping, sawing, grinding, etc. Up to 500% savings through increased cutting speeds and tool life. Check these quality features and write for complete details.

- —compact . . . measures 3" x 5"
- —separate air and coolant controls
- —convenient mounting stud
- —attaches to existing shop airline
- —shatter-proof 8 oz. reservoir
- —neoprene flexible coolant line
- —magnetic nozzle holder positions anywhere
- —controlled discharge

Larger Types and Capacities Available.

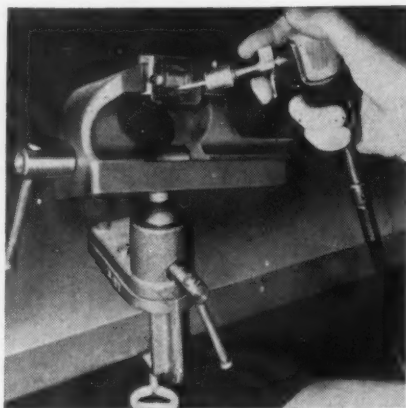
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TRICO FUSE MFG. CO.
MILWAUKEE, WIS. U.S.A.

For more data circle 473 on Postpaid Card

220 MODERN MACHINE SHOP

new equipment . . .



View shows Engis Tilt-Swivel Vise Clamp

veloped a bench clamp that bolts to the Tilt-Swivel Vise and makes possible rapid mounting and change of bench location by merely loosening the clamp screw. The ball joint of the Tilt-Swivel Vise permits swiveling through 360 degrees and tilting to 30 degrees up or down in any position. The clamp provides a fast, easy set-up for such operations as precision filing, drilling, reaming, grinding or finishing. Work is held securely in position most convenient to operator and with the clamp accessory, the entire assembly can be quickly moved from one position to another. Clamps are provided for both the large vise and the small one.

Also available are separate serrated tool steel jaws that can be easily interchanged with the standard unserrated jaws of the vise.

For more data circle 114 on Postpaid Card

★ modern machine shop ★

UNIVERSAL CUTTER GRINDER

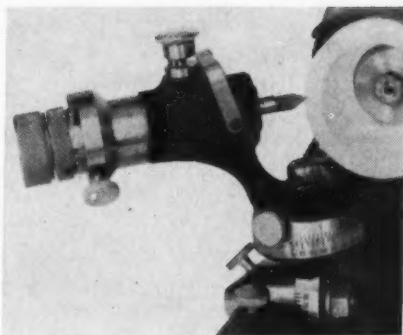
H. P. Preis Engraving Machine Co., 657 U. S. Highway 22, Hillside, N. J., has announced its Model CG-21 Universal Cutter Grinder for sharp-

June, 1961

ening single lip engraving and routing cutters. This universal cutter grinder is capable of grinding any profile. It is equipped with a universal cutter head which permits the operator to sharpen single lip cutters to any side angle or shape, including ball or round nose cutters. Accurate side clearances and tip or end rake are achieved without removing the cutter from the collet. The cutter head is equipped with an index unit for grinding also 2, 3 or 4 sided cutters. The universal cutter head is graduated from 0 to 90 degrees for side angle, from 0-45 degrees for side clearance and from 0-35 degrees for tip or end rake. It takes split collets for straight shank cutters up to 1/4 inch diameter and collets with internal taper for standard tapered shank cutters.

The feed screw dial which controls the depth of grinding is graduated in 0.001 inch for accurate grinding of the cutter tip diameter.

The grinding wheel is cup shaped,



Model CG-21 Universal Cutter Grinder

has a 2 1/4 inch diameter and is mounted directly on the ball bearing motor which operates at 10,000 r.p.m. on any a.c. or d.c. outlet.

Grinding wheels for high speed steel cutters are stocked in 60, 80, and 100 grit and diamond impregnated wheels for tungsten carbide cutters in 100, 240 and 500 mesh.

For more data circle 115 on Postpaid Card

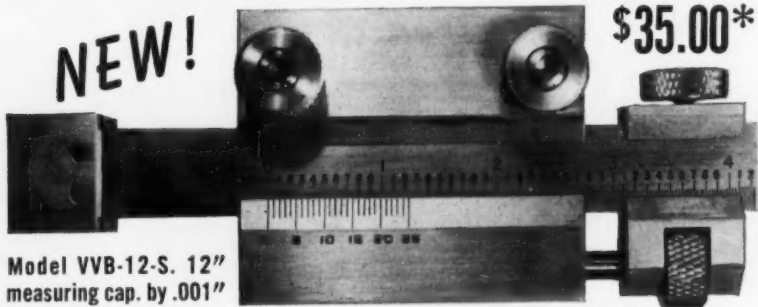
VERNI-TROL

Pat. appl. for

A PRECISION ATTACHMENT FOR MEASURING LENGTH OF CUT ON LATHES AND OTHER MACHINE TOOLS WITH SPEED, ACCURACY, SAFETY.

NEW!

\$35.00*



*** Model VVB-12-S. 12" measuring cap. by .001"**

Write for details on other models.

**ROBERT E. PLATT
MACHINE PRODUCTS**

#1 BUSTLETON PIKE • FEASTERVILLE, PA.

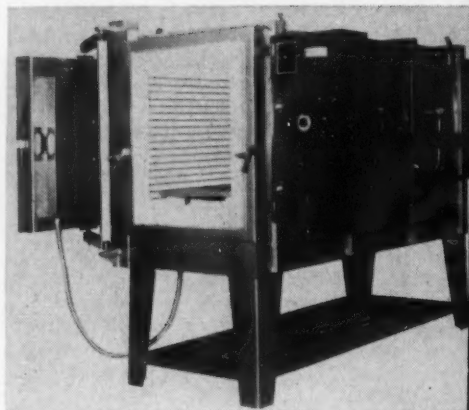
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new equipment . . .

ELECTRIC FURNACE

Recently announced by the L and L Manufacturing Co., 804 Mulberry St., Upland, Pa., the Model LP-2472H Dyna-Trol electric furnace has a diversity of applications in many industries. Its wide range of temperatures makes it applicable for heat-treating, drawing, glass annealing, and so on. With fans removed, temperature can be controlled from 300 degrees F. to 2300 degrees F.; with forced convection fan, 150 degree F. to 1875 degree F. temperatures can be accurately controlled.

Basically, the Model LP-2472H incorporates many features of the entire Dyna-Trol line of electric furnaces. Some of these Dyna-Trol features include input controllers which control a uniform degree of heat; and zone gradient control which operates by multiple circuits, with each circuit



Model LP-2472H Dyna-Trol Electric Furnace

having its own input controller. Gradients are indicated by a pyrometer and thermocouples located zonewise and elements are supported by specially designed Dyna-Glow elements holders, which are claimed to provide excellent heat transfer properties.



Cuts up to
2,000
tubes per hour

PAYS for ITSELF NO MATERIAL LOSS

Continental PIPE AND TUBE Rotary Cut-Off Machine

It zips right through tubes from $\frac{3}{8}$ " to $1\frac{1}{4}$ " O.D., from light gauge to 16-gauge wall thicknesses. Adjustable table with Tri-Roller Assemblies and Manual Stock Loader. Also Cut-Off Machines up to 12" diam., air or hand-operated.

Machine Rental Plan

Continental

SINCE 1919

machine co.

2345 W. NELSON ST.

CHICAGO 18, ILL.

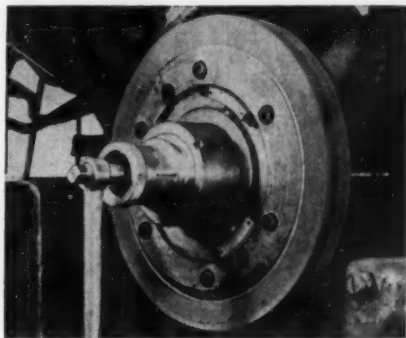
For more data circle 475 on Postpaid Card

A low mass characteristic keeps overshoot and undershoot of the temperature control point to an absolute minimum, especially when using automatic temperature controls. Rigid element support and easy element replacements are additional features. For more data circle 116 on Postpaid Card

★ modern machine shop ★

GRINDING WHEEL BALANCER

A portable grinding wheel balancer, announced by Balancing Equipment, Inc., 1928 Broadway, Fort Wayne, Indiana, is said to offer savings up to 80 percent in balancing, without removing the wheel from the machine, and is made for almost all kinds of grinders. The balancer handles wheels of various sizes, including large centerless and cylindrical wheels, with ease. Exhaustive vibration testing shows repeated accuracy within 0.000040 inch displacement. The aver-

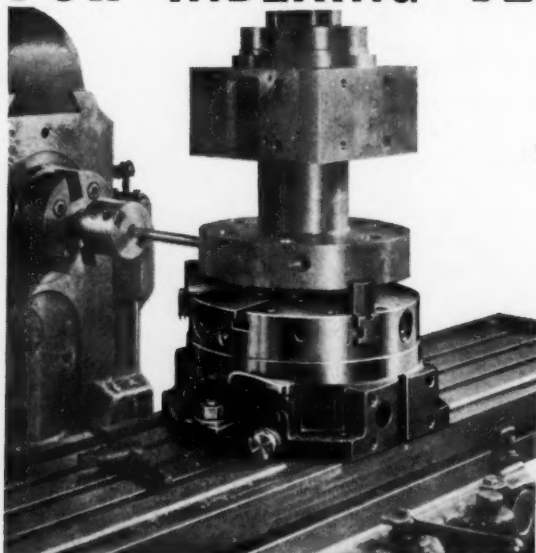


View of Portable Grinding Wheel Balancer

age time to balance is under 30 minutes for centerless or cylindrical wheels, so the company states. Few bearing replacements are necessary and savings are made in machine down time and costly abrasives being dressed away by attempts to correct imbalance.

For more data circle 117 on Postpaid Card

FOR INDEXING VERSATILITY



The Hartford Special Super Spacer

manually operated indexing device

Versatile: 3 sizes — 8", 12", 24" diam.

Mount your own fixtures or
any type of chuck

Rugged — Accurate

Write for bulletin and prices on
this all 'round shop aid.

The Hartford Special Machinery Co.
3700 College Highway
Simsbury, Connecticut

HARTFORD
Special

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SIZE POINT TAPER REDUCE

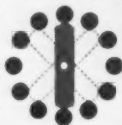


at high speed and low cost without wasting an ounce of metal, with

BENCH MODEL SWAGERS

Torrington Precision Swagers will save time, money and material in countless forming and assembly operations in your metalworking shop. Write for complete information on our full line of swaging machines — large and small.

*largest maker and user
of rotary swaging machines*



**ROTARY SWAGING MACHINES
THE TORRINGTON COMPANY**

Torrington, Connecticut

For more data circle 477 on Postpaid Card

224 MODERN MACHINE SHOP

new equipment . . .

CHILLING UNIT

The Model BF95-B Chilling Unit introduced by A. M. Harris Industries, Inc., 217 East Second St., Cincinnati 2, Ohio, is ideally suited for stabilization of metals, quick aging of steel, chilling to increase tool life, and so on. The unit has a temperature range to minus 120 degrees F. and an all steel construction with a galvanized chilling chamber of 12 gauge steel. The unit is equipped with an air cooled condenser; no liquid coolant is required. A liquid agitator provides a uniform temperature throughout the chilling chamber.

Outside dimensions are 34 inch by 22 inch by 44 inches high; chamber dimensions are 24 by 12 by 12 inches deep. Electrical circuit is 230 volts, 60 cycle, 1 phase. So-Low cascade refrigeration system provides maximum thermal capacity.

For more data circle 118 on Postpaid Card



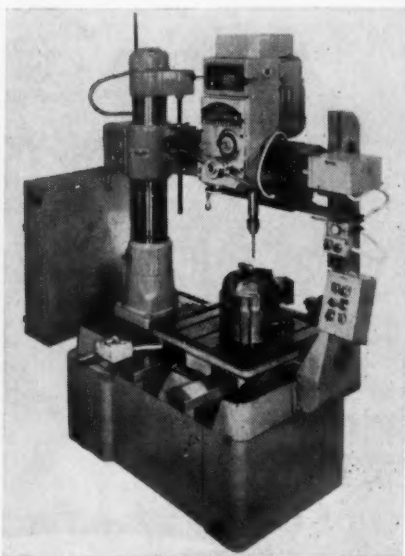
View of Harris Model BF95-B Chilling Unit

June, 1961

DRILLING MACHINES

A line of Veetmatic Precision Drilling Machines, with semi-automatic or numerical control has been introduced by Veet Industries, East Detroit, Michigan. Available in 3 models, these machines can be obtained with Singer Numerical Control.

The basic rigidity of the short-column Veet Precision Radial Drill, with its precision construction and boring type spindle, provide the foundation for spacing and positioning accuracy. A gantry column adds further rigidity. Positive locking of the arm at the main column and at the box-construction gantry column is power-operated automatically whenever the arm is repositioned. Special X-member and ribbing is cast into the base for extra rigidity. An "X"-axis measuring system is built into the arm, traversing the drilling head by servo-motor drive with ball screw through a range of 20 inches. Measur-



Veetmatic "T" Precision Drilling Machine

June, 1961

PRODUCTION MEN!

CAN
YOU
APPLY

20

TONS PSI

WITHOUT SCORING OR GALLING?

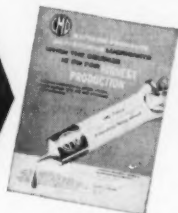


YOU CAN WITH CMD
EXTREME-PRESSURE
ANTI-SCORING
LUBRICANTS

HERE IS A MOST REMARKABLE LUBRICANT for lathe centers, steady rests, thrust bearings, broaching, swaging, tapping—any operation where you must eliminate metal-to-metal contact!

LABORATORY TESTS PROVE CMD to be the only lubricant to withstand EXTREME pressures.

Read how big industry has solved reject problems, longer runs at savings up to 81% over commonly used lubricants. Free booklet of testimonials, new uses, new lubricating facts. Write:



**CHICAGO MANUFACTURING
& DISTRIBUTING COMPANY**

1928 W. 46th St. • Suite 9-G • Chicago 9

For more data circle 478 on Postpaid Card

MODERN MACHINE SHOP 225

new equipment . . .

ing bars, servo-micrometers and position indicators are all conveniently located in front of the operator. Spindle runout is less than 0.0002 inch.

An "Y"-axis measuring system is built into the 25 by 25 inch precision table, which never overhangs its double-length 4-inch wide hardened and ground ways in its 20-inch travel. With rapid traverse of 60 inches per minute, the table quickly positions workloads up to 1,000 lb.

Model "S" Semi-Automatic is ideal for toolroom use to eliminate layout work and cut machining time on single to several-piece lots, wherever hole locations require accuracy just short of jig-bore limits. Many jobs can be completely machined in little over the time ordinarily taken for layout on a surface plate, with holes

held to plus or minus 0.001 inch of true location. Tape control can be added to Model S at any time without discarding any parts or without loss of original investment.

Model "T" operates from standard 8-channel one inch tape and provides fully automatic positioning at maximum reliability. The tape, punched with user blueprint location dimensions, is fed into the tape reader to control positioning in both axes from a starting point. Positioning accuracy is plus or minus 0.001, with repeatability of plus or minus 0.0002 or less. Model "C" does the same from pre-punched IBM type cards.

The measuring system is completely independent of the traversing mechanism, ball screws and drive motors, which traverse the head and table. Basis of measuring accuracy is an isometric measuring bar calibrated to ten-millionth inch accuracy.

For more data circle 119 on Postpaid Card



MONEY-BACK TRIAL OFFER
Order a trial gallon of each today for testing in your shop. We'll cancel the bill if you're not satisfied.

PREVENTS HEAT TREAT SCALE . . .
up to 1500°F. Brush on, heat, brush off. All metals.

cut weld cleaning time by 85%

Throw away your cold chisel and whisk off weld spatter with a dry rag! Protect-O-Metal spatter-proofing compounds make weld cleaning a breeze. Improve your welds at the same time . . . P-O-M compounds quiet the arc, improve fusion and electrode operation, prevent oxidation and annealing scale, cause no porosity. No smoke odors, or fumes.

P-O-M No. 2. Non-inflammable, non-toxic water-soluble paste. Inorganic. Thin before applying and start welding at once. \$3.40 per gallon, f.o.b. Dayton.

P-O-M No. 8. Rust- and corrosion-resistant resin base compound. Comes ready to use. Safe for all metals. Good paint primer; permits outdoor storage of subassemblies. \$3.45 per gallon, f.o.b. Dayton.

PROTECT-O-METAL

G. W. SMITH & SONS, INC.

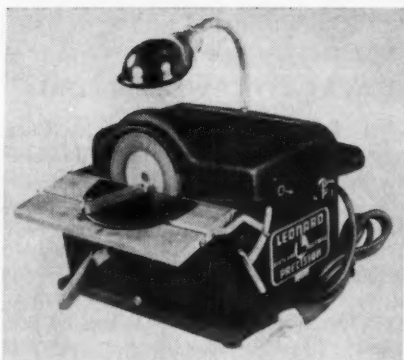
1702 SPAULDING RD., DAYTON 3, OHIO

For more data circle 479 on Postpaid Card

GRINDING AND LAPPING MACHINE

Leonard Precision Products Co., Grind-R-Lap Div., 9200 Bolsa Ave., Santa Ana, Calif., has announced the single head Grind-R-Lap, with quick change ring type wheels, which grinds and lap carbide, H.S.S. and ceramic tools. Alnico magnets, set into the head, holds wheels firmly and accurately, yet permit instant changing with fingers only. Wide base protractor has attached pivot bar which rotates 180 degrees, sets and locks at any desired angle.

The tool to be sharpened is simply placed against the pivot bar and is then automatically in position for the entire grinding or lapping operation. The head revolves with an oscillating pendulum motion, moving the wheel with a three-directional stroke across the tool face. The operator never needs to reposition the tool except to maintain tool contact with wheel. Tilt



View of Leonard Single Head Grind-R-Lap

table, operated by single handle, registers degree of tilt automatically on dial at side of machine. The grinding wheel, plated with solid concentration of diamonds, grinds cool and never needs to be dressed. The Grind-R-Lap operates on any lighting circuit. For more data circle 120 on Postpaid Card

Beverly THROATLESS SHEAR

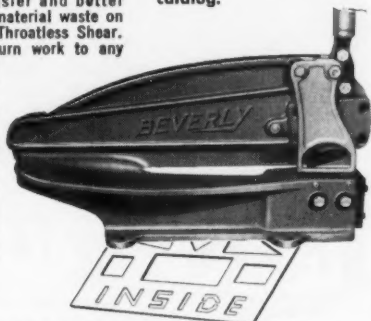
Cut any Shape... STRAIGHT OR IRREGULAR



B-3 with Ball Bearing Hold Down

Make any cut — curved, straight, or irregular, faster, easier and better with less material waste on a Beverly Throatless Shear. You can turn work to any

position and make a clean cut as you go. Handles heavy gauges with ease—lighter metals without distortion. 4 models — capacities 18 gauge to 3/16" mild. All shears equipped with H.C. H.C. Blades for cutting Stainless.



INSIDE SLOTTER

8" Reach — 16 ga. cap.

Makes inside slotting cutting faster, easier, cleaner. Punch and die arrangement of 5 blades assures accuracy, clean cutting action. Cuts 2 1/2" x 1/8" slot at one stroke. Throat design permits pivoting work at any point in stroke for special inside cuts. Note sample cuts.

See your Beverly Dealer or write for illustrated catalog.

BEVERLY SHEAR MFG. CORP., 3000 W. 111th ST., CHICAGO 55, ILL.

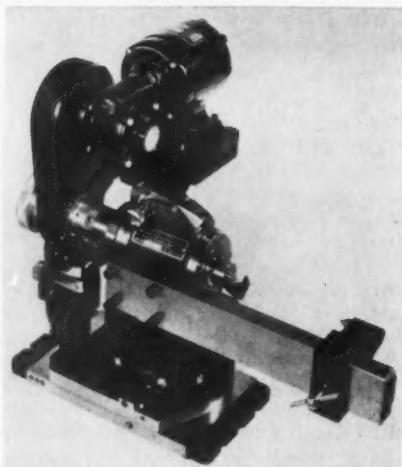
For more data circle 480 on Postpaid Card

new equipment . . .

HEAVY DUTY CENTER SUPPORT

A heavy duty support bar has been announced as an option on the R-O fixture by R-O Manufacturing Co., 31171 Stephenson Highway, Madison Heights, Mich. The support consists of a single bar with $2\frac{1}{4}$ square inch cross section, practically eliminating any center deflection or distortion in grinding long tools. Size the rectangular shape of the support provide maximum rigidity for supporting the extended center when tools are ground between centers, and for holding bushing type steady rest supports for long tools.

A second advantage lies in the fact that a full 6 inch swing is provided with the support so that larger diameter taps and other tools can be ground on the fixture. The support is available only on R-O fixtures when speci-

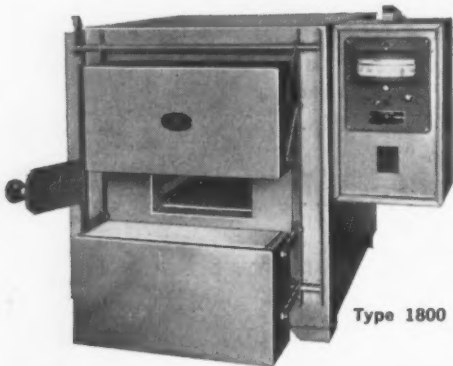


View shows R-O Heavy Duty Support Bar

fied. According to the company, existing fixtures cannot be properly converted for the support bar.

For more data circle 121 on Postpaid Card

the new BIG bench-type furnace for heavy production heat-treating



Type 1800

An all-new TEMCO electric furnace specifically designed to let you heat-treat more and **bigger** parts in a bench-type unit. **Larger chamber size . . . 10" W, 9½" H, 22" D.** **Higher temperature range . . . continuous up to 2000° and 2300° F (1095° and 1260° C) . . . handles most high-speed steels.**

This new Type 1800 TEMCO furnace features a close-sealing sectional door with patented lever suspension to provide limited or full access as desired. Reinforced welded steel case . . . 7½" firebrick and backup insulation. Choice of single or three-phase models, for 208, 230 or 460 volts. Available with or without controls. \$685 to \$745 furnace only.

Write for new TEMCO-THERMOLYNE literature and name of nearest dealer



ELECTRIC FURNACES THERMOLYNE CORPORATION

(formerly Thermo Electric Mfg. Co.)

488 Huff Street, Dubuque, Iowa

For more data circle 481 on Postpaid Card

INDUSTRIAL PRESS

A "four-in-one" industrial press incorporating a unique design principle which permits the performance of functions normally requiring four standard presses of varying sizes, has been announced by Dechert Dynamics Corp., Palmyra, Pa. The pitman, or connection, instead of riding on the shaft, is mounted on an eccentric tapered bushing whose position can be changed and locked to any one of four marked positions to obtain the

desired stroke. Stroke ranges from one-half inch to one-and-a-half inches or, on larger presses, from one inch to three inches.

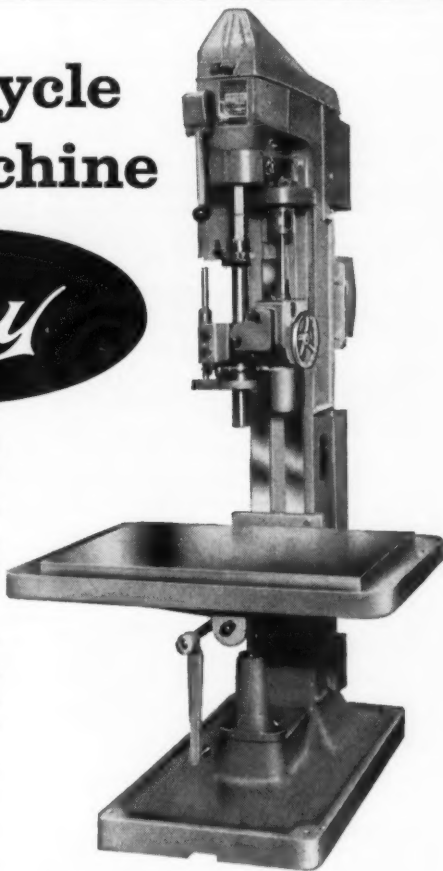
The adjustable stroke mechanism consists of two key parts: the eccentric tapered bushing, and a locking ring nut. The locking ring is an integral part of the shaft. Changing the stroke is readily accomplished by loosening the ring nut and eccentric bushing which disengage the key. The key is then realigned with the slot on which

automatic cycle drilling machine



You can chop your time costs with automatic set-ups on this new Avey machine, and still take advantage of the low cost and flexibility of a standard unit. Adjustable rapid power traverse, feed, and rapid return of the spindle permit automatic transfer or rotary index fixturing. You also get adjustable feeds, speeds, table travel, head travel, and Avey's precision spindle. Morse Taper 2, 3, or 4; single or multiple spindles 1 to 5 hp. *Write or phone for data.* Avey, Box 1264, Cincinnati 1, Ohio.

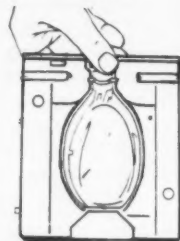
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in making bottle molds

CERROTECHNICS is the practice of using low-temperature melting CERRO® ALLOYS to expedite many industrial operations.



*T.M. Cerro Corp.

For instance: This polyethylene mold is made by spraying a pattern secured to a metal plate with molten CERRO ALLOY to a depth of $\frac{1}{16}$ " , then removing and incorporating in a chase. Write for further information.

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SUBSIDIARY OF CERRO CORPORATION

Room 1501, 300 Park Ave., New York 22, New York

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**USE IT
EITHER WAY**

VERTICAL

HORIZONTAL

At last, a top quality industrial sander that provides all the most wanted features - yet sells for so little. **\$89.95**

complete-with cord, plug, switch ready to use
Work table in vert. illus. optional.

Illustrated Literature on Request

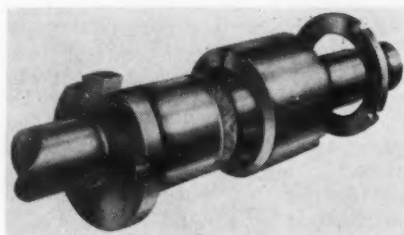
A few desirable distributor territories still available

WALLS SALES CORPORATION

59-63 Van Dam St. Brooklyn 22, N. Y.

For more data circle 484 on Postpaid Card

new equipment . . .



Heart of Dechert Varistroke Press is eccentric tapered bushing (center) which can be locked into one of four slots (left) to deliver strokes varying in length from $\frac{1}{2}$ to $1\frac{1}{2}$ inches, and from 1 to 3 inches in larger presses.

the desired dimension is marked. Tightening the ring nut presses the key into the desired slot, making the press ready for operation.

The "four-in-one" press, in addition to permitting a wide work range, reduces die travel and slide velocity to a minimum. Low cost maintenance and less machine "down time" result from less wear-and-tear on the die set, die, slide, jibs, and other critical parts.

The adjustable stroke is available on presses up to 50 tons.

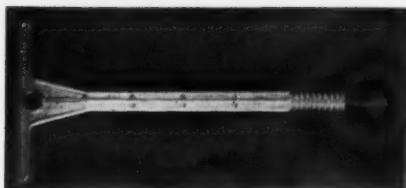
For more data circle 122 on Postpaid Card

★ modern machine shop ★

HANDLE WRENCH

The Hex "T" Handle Wrench which has been announced by Bowersox Precision Castings, Inc., 3523 West Ninth St., Chester, Pa., is designed for hex socket screws. The wrench makes it easier to tighten these screws in deep, hard-to-reach recesses or counterbores and therefore cuts assembly time.

The wrench has a die cast zinc alloy handle, cast to a high grade tool steel bit, and sizes range from $\frac{5}{64}$ inch to and including $\frac{3}{8}$ inch. The bit size is



View of Bowersox Hex "T" Handle Wrench

cast on each wrench to eliminate the "hunt-and-try" system. The hanging hole in the center of the handle makes it easy to "hang-on-to."

For more data circle 123 on Postpaid Card

★ modern machine shop ★

LEAD SCREW TAPPING UNIT

Procurier Safety Chuck Co., 18 South Clinton St., Chicago, Ill., has announced a variable speed lead screw tapping unit. Electrically controlled, air operated, completely self contained with motor, speed regulator and lead screw, the unit offers a new high in flexibility, adaptability and high speed precision tapping.

The stroke of the unit is built into the tapping head which functions by means of a lead screw assembly. Conventional air and hydraulic feeds are eliminated, reducing maintenance and down time. Accurate depth stop holds uniform depth within $\frac{1}{4}$ turn and provides uniform threads. The unit

also has "safety" return button which stops tapping action instantly. A friction clutch and low air pressures prevent tap breakage should tap strike obstructions. The unit is said to tap blind holes to the bottom without danger.

Lead screws can be easily and quickly changed in seconds and are adjustable for wear. Lead screws are precision ground after hardening, as-

CAM milling/JIG boring



A SPECIALIZED CAM MILLING SERVICE, JIG BORING, SPOT WELDING, CONTRACT PRODUCTION

EXPERIMENTAL DEVELOPMENT

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EISLER ENGINEERING CO., INC.
Chas. Eisler, Jr., President

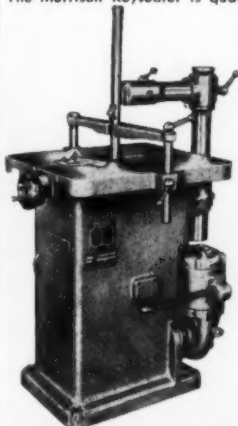
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This new MORRISON KEYSEATER can make money for you

Install it in your shop. Its low cost will amaze you. Watch it pay for itself. You can quickly eliminate costly production tie-ups caused by waiting for expensive outside services. This is not an ordinary keyseater. The Morrison Keyseater is quality built with machine

tool accuracy. Practically anyone can operate it. It has automatic feed, automatic stop to cut off feed at given depths, automatic relief to back the work away from cutters, automatic centering, automatic lubrication. NO BUSHINGS REQUIRED. Cuts keyways $\frac{1}{16}$ " to 1". FREE new Catalog 714-A shows all features and specifications can be had by writing:




THE D. C. MORRISON CO.

P. O. Box 1017-B
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NOW FASTER READING DIAL CALIPER



- Designed for fast precision • Engraved graduations simplify reading—Knife jaws for inside measurement, outside and depth measurements—can be locked in position—All operating components are completely enclosed • Precision built from stainless steel and brass • 4 Models: 6"—\$39.00, 8"—\$42.00, 12"—\$59.80, 24"—\$166.30.

WRITE TODAY FOR FREE LITERATURE — Dealer Inquiries Are Invited.

TITAN TOOL SUPPLY CO.

Box B, 68 Comet Avenue, Buffalo 16, N. Y.

For more data circle 486 on Postpaid Card

June, 1961

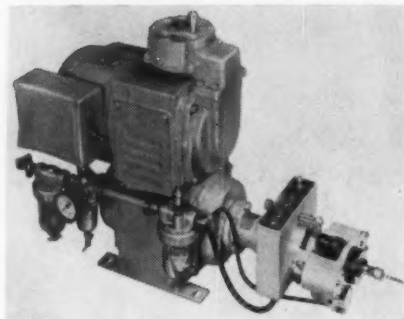
MODERN MACHINE SHOP 231

new equipment . . .

asuring class 3 threads at every stroke. The fast, smooth, gentle action of the lead screw, with reverse speed twice as fast as forward, provides continuous, accurate tapping without variation, eliminates need for hold down clamps or strippers in fixtures.

The variable speed units are available in 2 models. The 1/2 h.p. unit has infinite speed range of 537 to 2150 r.p.m., a tap capacity of 0 to 1/4 inch and length of stroke is 1 1/16 inch. The 3/4 h.p. unit has an infinite speed range of 292 to 1170 r.p.m., a tap capacity of 1/4 to 3/4 inch and length of stroke is 2 1/2 inch.

Variable speed pulleys are mounted between oversize pre-lubricated double shielded bearings, providing no overhanging load. All units have heavy duty ball bearing motors, sealed for life against dirt, grit and coolant, requiring no lubrication. Special built-in



View of Procunier Lead Screw Tapping Unit

controls provide single cycle, jog or automatic operation with the flick of a switch.

For more data circle 124 on Postpaid Card

★ modern machine shop ★

PUNCH PRESS

Kenco Manufacturing Co., 5211 Telegraph Rd., Los Angeles 22, Calif., has announced a series of presses called the Kenco Kompacs, available in 3 and 5 ton capacities. Exclusive features are a totally enclosed yet easily accessible flywheel, crankshaft, connection rod and ram; rear-mounted flywheel; and a new self-contained interchangeable power transmission unit which is available in various stroke lengths from 1/4 inch to 2 inches. An important advantage to this is that a power transmission unit of a different stroke length can be

"TORQUE WRENCH" MANUAL

Sent upon request

Formulas
Applications
Engineering data
Screw torque data
Adapter problems
General principle

P.A. STURTEVANT CO.
ADDISON QUALITY ILLINOIS

Manufacturers of over 85% of the torque wrenches used in industry

For more data circle 488 on Postpaid Card

232 MODERN MACHINE SHOP

PRECISION TOOL GRINDER

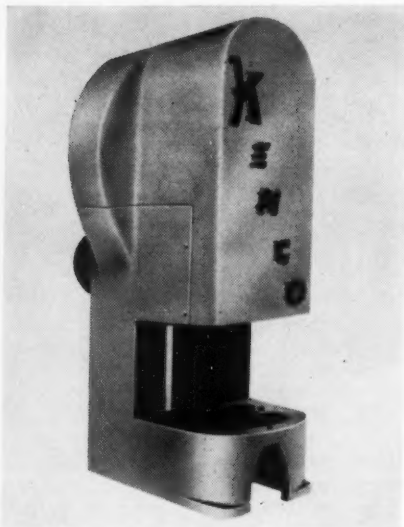
"KSM" with Indexing Head for tools up to 2" diameter.

Write today for catalog.

ANTARES INSTRUMENTS INC.
55-02 37TH AVE. • WOODSIDE 77, N. Y.

For more data circle 489 on Postpaid Card

June, 1961



View shows Kenco Kompac Series Press

changed in minutes by merely removing four bolts, disconnecting the ram and flywheel, and slipping another unit into position. Power units contain a one piece crankshaft mounted on heavy roller bearings in a lubrication reservoir; a quiet, indestructible "Cyclo-Safe" Roller Clutch; a solenoid operated trip action for positive trouble-free single tripping; and a brake for precise stopping.

Overall advantages of the Kompac are operator safety, simplicity in design, high precision punching, and

increased service life. A shorter crankshaft, fewer moving parts, and reduced friction are said to cut the starting and stopping load 75 percent, resulting in no appreciable wear of parts. The frame is a multiple ribbed 60,000 p.s.i. sorbitic casting. A 1/3 h.p., 1750 r.p.m. motor and an electrical foot or hand control switch are included.

For more data circle 125 on Postpaid Card

monroe
THE MOST PROGRESSIVE
FIXTURE CLAMP LINE

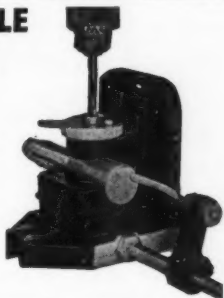
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PHONE: BRoadway 2-2984

For more data circle 490 on Postpaid Card

ADJUSTABLE DRILL JIG

- eliminates layout
- cuts drilling time



Used for drilling holes through round stock and hex stock from 1/4" to 2" and cap screws from 1/4" to 1 1/4", the new Mathewson Adjustable Drill Jig eliminates layout and can cut drilling time on small lots to a fraction. And it eliminates the costs of special jigs for larger quantities. • Holes for cotter pins, set screws, drive pins for bayonet joints, oil holes in tubular sections, and wiring holes in cap screws, are all typical of the operations that can be done more economically with this jig. Hole diameters range from .052" to .531", using your A.S.A. standard slip bushings. • The hardened V-block has two 60-degree V's for centering round or hexagonal stock, one for 1/4" to 2 1/32" diameter, one for 2 1/32" to 2" diameter. Adjustable stop for locating work longitudinally for drilling any distance from end, may be used on either side. Adjustable bushing carriers hold slip bushings and clamp work securely. • Jig highly successful in permitting use of inexperienced drill operators. For circular write to: Mathewson Machine Works, 40 Hancock St., Quincy 71, Mass.

For more data circle 492 on Postpaid Card

PRECISION TOOLMAKER'S VISE

Precision ground to a maximum permissible error for squareness of .0006" per inch—NOT CUMULATIVE. Hardened throughout. Totally enclosed screw. Easy clamping to machine tables.



PRICES	
1 1/4" Jaw	\$34.50
1 1/2" Jaw	\$48.75
2 1/2" Jaw	\$77.50

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AMITYVILLE, NEW YORK

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June, 1961

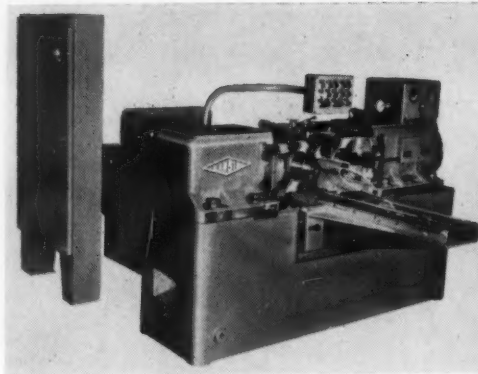
MODERN MACHINE SHOP 233

new equipment . . .

THREAD ROLLING AND FORMING MACHINE

Landis Machine Co., Waynesboro, Pa., has introduced the Landis Hy-Duty Thread Rolling and Forming Machine which is designed for the heaviest thread, form, spline and gear rolling applications requiring rolling forces of up to 200,000 pounds. The nominal diametrical capacity of the machine is from zero to 6 inch maximum or infeed rolling, and from zero to 4 inch maximum diameter for thru-feed rolling. Thread lengths of 11½ inches are obtainable for infeed rolling and up to 20 feet for thru-feed.

With hydraulically operated, infinitely regulable and electronically controlled infeed cycling and variable infeed stroke length, the machine is exceptionally versatile in application and offers power, rigidity and speed



Landis Thread Rolling and Forming Machine

from maximum efficiency within its rated capacity.

To withstand the machine's high rolling force capacity, the spindles are of 4½ inch diameter heat treated alloy steel. As heavy duty rolling requires large bearings, so the thread rolls are also large, ranging up to 12 inches in diameter by 12 inches in length. However, where the work to be rolled does not demand such heavy duty equipment, replaceable spindle units with 3 inch diameter spindles can be furnished, allowing smaller dies of up to 8 inch diameter to be used.

The power transmission is powered by a 50/25 h.p., 1800/900 r.p.m. motor through speed change gears. Six standard speeds are available from a minimum of 78 to a maximum of 476 for



Buy Cook "SHUR-GRIP"

LEAD HAMMERS—

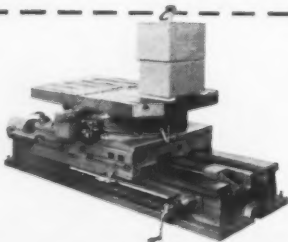
They're a **MUST** in every shop where many blows have to be struck without marring surfaces. Available with "SHUR-GRIP" drop forged handles.

Write for circular and prices

COOK LEAD HAMMER SERVICE

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new AIRMIST tables index extra-heavy loads

6600-lb. load indexes easily on new 50" x 72" offset AIRMIST table. Range of standard sizes available, 36" and larger; special sizes on request. Any AIRMIST table can be furnished on runways for use with floor type boring mills.

THE CINCINNATI GILBERT MACHINE TOOL COMPANY • CINCINNATI 23, OHIO

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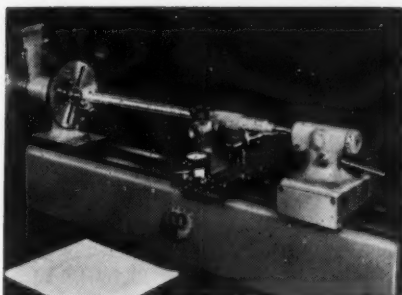
the 50 h.p. range, and from 39 to 233 for the 25 h.p. range. The worm gear transmission and speed change gear box are said to be rated 90 percent efficient at maximum speed.

For more data circle 126 on Postpaid Card

★ modern machine shop ★

SPACING-CHECK SYSTEM

A simple tooth-space checking system that also graphically helps identify causes of tooth-spacing errors in straight or helical gears and splines has been announced by Michigan Tool Co., 7171 E. McNichols Rd., Detroit 12, Mich. This system provides a simple means of measuring pitch-line run-out and eliminating its effects on an index check. The inspection can be accomplished without the necessity for analysis by a highly trained man. A very short training session in the technique of the system enables the



View of Michigan Model 1132 Tooth Spacing and Concentricity Checker Unit

average machine operator to check toothed parts and accurately determine tooth-spacing errors.

The basic new Michigan system comprises a checker of new design, translucent charts and a light table. Since the system is designed for either production checking or laboratory use,

SLOTS • GROOVES • RECESSES

CUT FASTER



ALL narrow slotting or slitting operations... where slotting saws cannot be used because of arbor interference... can now be performed faster with Quality Tool narrow width Woodruff style slotting cutters!

With set-up time materially reduced... these Quality Tool high speed steel, hollow ground narrow width Woodruff style slotting cutters CUT slots, grooves, recesses, etc. into inside diameters, cavities, pockets or recessed areas.

WITH QUALITY TOOL

Narrow Width Woodruff Style Slotting Cutters



ORDER NOW...
for immediate delivery from stock from these sizes.



QUALITY



TOOL WORKS

Manufacturers of a Complete Line of Standard and Special Woodruff Keyseat Cutters

330 South Elmwood • Waukegan, Ill.

Diameter	STANDARD WIDTHS—AVAILABLE FROM STOCK															
	.020	1/32	3/64	1/16	5/64	3/32	7/64	1/8	9/64	5/32	11/64	3/16	7/32	1/4	5/16	3/8
1/2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
5/8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
3/4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1-1/8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1-1/4	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1-3/8	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*
1-1/2	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*	*

* AVAILABLE FROM STOCK—NARROW WIDTH WOODRUFF CUTTERS—LIST 115

** AVAILABLE FROM STOCK—STANDARD WOODRUFF CUTTERS—LIST 100

Standard tolerance on width is ± 0.001 . Right hand cut standard. Widths other than shown can be made by modifying next size larger. Also available with solid carbide heads brazed to steel shanks... on special order only.

• DISTRIBUTOR INQUIRIES... Welcome!

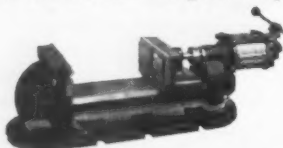
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new equipment . . .

mechanical units are rugged and adjustments can be made quickly.

The new Michigan Model 1132 Tooth Spacing and Concentricity Checker used with this system comprises a bed with ways, an adjustable pointer carriage and slide, two dial indicators and a pair of centers. The standard unit (larger checks are avail-

"GEM" AIR VISES — "for greater capacity"



#2 GEM Air Vise—Instantly adjustable to any capacity up to 6½".

\$120.00 delivered, guaranteed.

Also GEM AIR VISES from 3" to 12" capacity.

Write for details.

J. E. MARTIN MACHINE CO. • SPRINGFIELD, OHIO

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ACCURACY is an ECONOMY!
and only precision offers you
HIGHEST QUALITY!

now is the
time
to put your
**OLD STEEL
PARALLELS** to "LIKE NEW"
conditions and to be ready for the big push.



For the first time Anton Machine Works offers to regrind your old parallels to the following tolerances:

- Parallelism and straightness over length of 6" $\pm .0001$
- Size tolerance between a pair $\pm .00005$. A complete list of new parallels in stock will be mailed on request.

ANTON MACHINE WORKS

1226 FLUSHING AVE., BROOKLYN 37, N. Y.

For more data circle 497 on Postpaid Card

able) will accept shafts up to 36 inches long and 5 inch o.d. having a wide range of pitches. This unit features a quick-acting adjustable tail-stock and over-travel protection for both indicators.

The workpiece is positively indexed through use of an index plate, several of which for different numbers of teeth, odd or even, can be simultaneously mounted on the checker. A rack-type pointer tip pivots so it contacts both flanks of a tooth near the pitch line at the time measurements are taken. The pointer unit can be swiveled so the tip matches the helix angle of the workpiece.

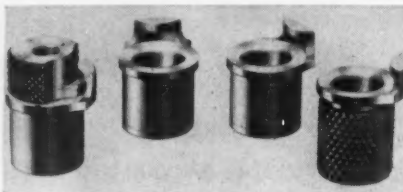
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★ modern machine shop ★

DRILL BUSHING LOCK LINERS

Drill bushing lock liners now being marketed by American Drill Bushing Co., 5107 Pacific Blvd., Los Angeles 58, Calif., are said to eliminate the lock screw formerly required to secure slip renewable type drill bushings in place. Un-A-Lok Liners are provided with ground or unground outside diameters, or may be ordered with Delt-A-Liner outside diameters for use in plastic tooling. Any easy fingertip twist of the bushing either locks it into the liner, or removes it as desired for instant interchangeability. During drilling operations, the bushing is locked securely in the liner by rotation of the drill.

American Drill Bushing Company



Un-A-Lok Drill Bushing Lock Liners marketed
by American Drill Bushing Company

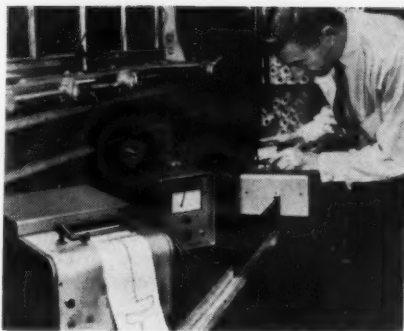
offers a complete line of tungsten carbide drill bushings. Several types of drill bushings are available, including head and headless press fit, fixed and slip renewable.

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★ modern machine shop ★

MEASURING AND RECORDING UNIT

Micrometrical Mfg. Co., 3621 South State Road, Ann Arbor, Michigan has introduced the Microcorder which consists of three essential units: an Amplimeter, a Recorder and a Piloter. Working together they provide a quick, accurate means of measuring and recording variations in thickness of metal strip. The Amplimeter amplifies electronic signals from the Tracer as it is piloted along the strip stock under its own power. A selection dial on the front panel of the Amplimeter makes possible a choice of 5 different



View shows Micrometrical Microcorder

vertical magnifications: 5 u" per division, 50,000X; 25 u" per division, 10,000X; 100 u" per division, 2,500X; 250 u" per division, 1,000X; and 1000 u" per division, 250X.

The Recorder provides a permanent chart record of the thickness variations and makes possible a choice of three different horizontal magnifica-

Make cuts **DEEPER** and **FASTER**

ROOFE Live Centers, praised by users everywhere, are made of finest materials under rigid quality controls.

ROOFE Standard Type Live Centers are popular because they offer maximum accuracy, lower costs, and increased production. Available in Morse Taper, Brown & Sharpe, Jarno. Straight and special shanks furnished to meet your "special" specifications. Write for our catalog.



with **ROOFE**
Standard
Type
LIVE
CENTERS

HOUSTON GRINDING & MFG. CO., Inc.

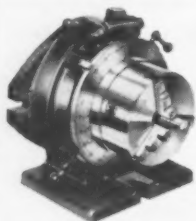
P. O. BOX 7461 • HOUSTON 8, TEXAS

For more data circle 498 on Postpaid Card

new equipment . . .

tions: 0.002 inch per division, 250X; 0.004 inch per division, 125X; and 0.010 inch per division, 50X.

The 4 inch wide strip chart is easy to read and reproducible by conventional means. The self propelled Pilot contains the Tracer mechanism and will traverse an 8 inch strip in approximately 90 seconds. Frequent Microcorder measurements on sample



INDEXING UNITS

**High
Accuracy
Low
Price**

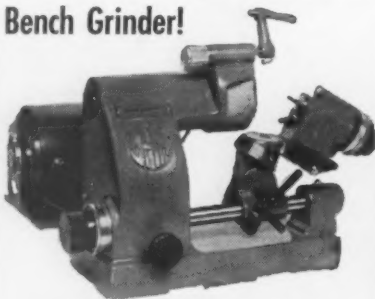
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**Precision Sharpen Your Die-
Sinking Cutters on an**

ALEXANDER

Bench Grinder!



Over 1,000 sold in United States.

Write to Dept. C for catalog.

J. ARTHUR DEAKIN, INC.

31 Roseland Ave., Caldwell, N. J.

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238 MODERN MACHINE SHOP

strip have resulted in savings of both time and money by pointing to strip stock that is non-standard. Mill rejects have been reduced 60 to 70 percent by one prominent steel company.

For more data circle 129 on Postpaid Card

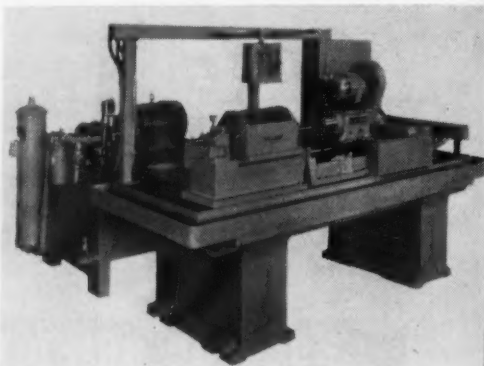
★ modern machine shop ★

GUN DRILL

Designed for production drilling of deep precision holes in ferrous or non-ferrous materials, using carbide tipped drills, a fixed bed gun drill announced by Leland-Gifford Co., Worcester, Mass., is offered with either a self-contained hydraulic feed or lead screw feed gun drilling unit. The bed can be furnished in appropriate dimensions to accommodate the fixturing for any size or shape work.

Recommended for drilling accurate holes up to $\frac{5}{8}$ inch diameter by 7 inches deep, the self-contained hydraulic feed unit offers the advantages of highly uniform feed rate with simple feed rate changing. Pump and spindle are independently powered with a $1\frac{1}{2}$ h.p., totally enclosed spindle motor driving through a timing belt drive. For general use, variable speed drives are available for speeds up to 10,000 r.p.m.

For holes having depth greater than



Leland-Gifford Model No. 24C Gun Drill

June, 1961

7 inches, the Leland-Gifford No. 24C Electro-Mechanical Gun Drilling Unit can be furnished with 12, 24 or 36 inch stroke. Driven by a 1½ h.p. Dynabrake motor through a non-slip timing belt, the spindle can be run at speeds from 720 to 12,000 r.p.m., with a 3600 r.p.m. motor or at 360 to 6000 r.p.m. with an 1800 r.p.m. motor. Feed is actuated by and synchronized to the spindle speed and can be changed through pick-off gears from a mini-

mum of 0.00019 inch per revolution to a maximum of 0.0015 inch in increments of 0.000015 inch if desired. A separate ½ h.p. motor powers the lead screw and permits rapid approach for set-up and rapid return.

This gun drilling equipment can be furnished as a complete machine, with base and hydraulic or lead screw feed, with or without tooling for specific operations, or as drilling units only on a do-it-yourself basis. Also avail-

Johnson on the job

At Pullman Standard Car Mfg. Co.

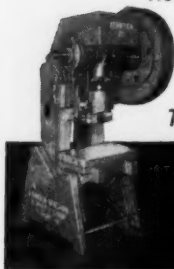
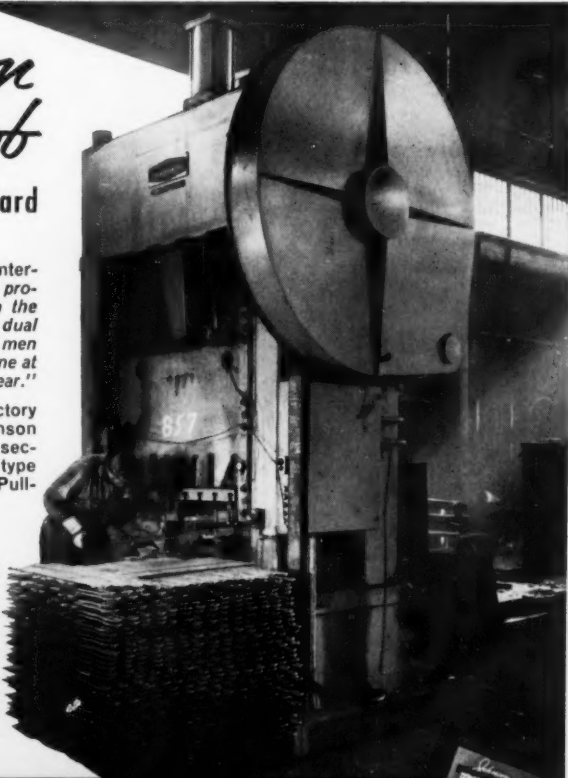
From an "at the plant" interview: "It is anticipated that production will be doubled on the Johnson, because it is a dual capacity press, allowing two men to work at the same time—one at the front, the other at the rear."

Solid proof of the satisfactory performance of the Johnson was demonstrated when a second order for the same type press was placed by the Pullman Standard firm.

50 Models of Johnson Presses

Inclinable,
Straight Side, Gap,
Horn

Special
Presses
Built
To Order



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JOHNSON MACHINE & PRESS CORP.

620 West Indiana Ave., Elkhart, Indiana

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circles you'll
find they
use only . . .

Ottomiller

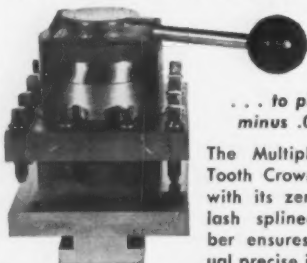
CAP SCREWS
SET SCREWS
MILLED STUDS

CUSTOM
SCREW MACHINE
SPECIALTIES

*Wm. H. Ottomiller Co.
YORK, PENNSYLVANIA

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REPETITIVE INDEXING IN ALL 12 POSITIONS



. . . to plus or
minus .0003

The Multiple Gear
Tooth Crown Clutch
with its zero back-
lash splined mem-
ber ensures contin-
ual precise indexing
in any and all 12 positions (60 positions
with special units). Write for folder.

Reliable Representatives Wanted



**OLSON INDUSTRIAL
PRODUCTS, INC.**

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WAKEFIELD • MASS.

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240 MODERN MACHINE SHOP

new equipment . . .

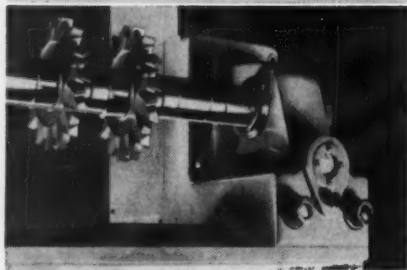
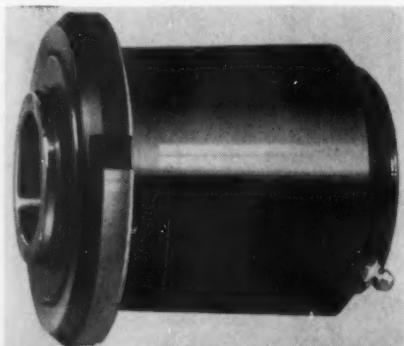
able is a high pressure coolant system
with an oil capacity of 100 gallons,
capable of supplying a constant, close-
ly controlled supply of clean oil under
high pressure.

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★ modern machine shop ★

ARBOR SUPPORT BEARINGS

An anti-friction arbor support bear-
ing, available in standard sizes to fit
machine's support housing without
re-boring, has been introduced by
Briney Mfg. Co., P. O. Box 208,
Pontiac, Mich. The bearings have a
large number of balls, distributed
evenly over the bearing race, that
provide full-length support, minimize
friction, give longer bearing life and



(Above) Briney Support Bearing and (Below)
the Briney Support Bearing in operation

June, 1961

increase arbor rigidity. This design eliminates stress and strain imposed on the bearing by lineal movement of arbor due to thermal changes. The bearings run cooler and last longer.

Since Briney bearings seat within the support housing, work and fixture interference is non-existent. These free-running support bearings allow higher feeds and speeds to fully utilize machine and cutter capacity.

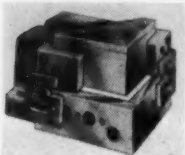
Reducing bushings are available for each size bearing so that a standard range of arbor diameters may be accommodated. Installation is said to be simple; merely fit the bearing in place and hold with lock nut. Special sizes are available; also anti-friction bearings of similar type for other applications.

For more data circle 131 on Postpaid Card

★ m m s ★

CORNER NOTCHING UNITS

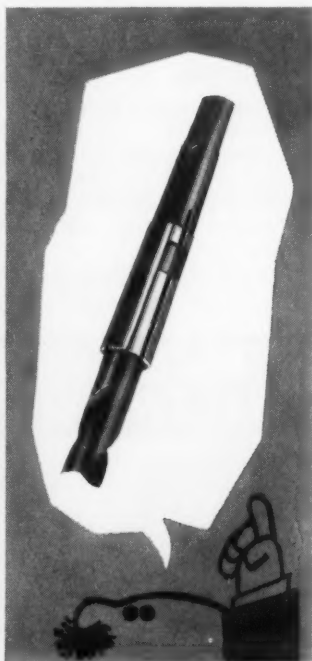
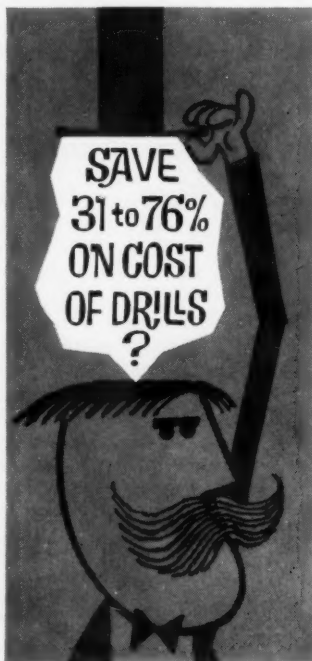
A series of corner notching units has been announced by the Tool Products Corp., North Tonawanda,



Tool Products Corner Notching Unit

N. Y. Features of this self-contained unit are the "cast-to-shape" tool steel punch that eliminates the need for a cap surrounding the punch and insures burr-free notching of parts. This "no cap" feature increases the versatility of this corner notching unit greatly as it can now be used for "V" notching or cropping of angles as well as "V" and corner notching of flat sheets.

The unit is available in both right



With Scully-Jones Style "B" Drill Chucks . . . those "reusable taper shanks" for inexpensive straight-shank drills. Besides saving 31 to 76% on price of taper-shank drills, you avoid their inventory cost. Positive, four-slot grip of a Style "B" chuck also drives reamers, end mills, and similar straight-shank tools. Ask for free literature—

Cost Saving Idea No. 2.

**SCULLY
JONES**

Scully-Jones and Company

1909 South Rockwell Street, Chicago 8, Illinois

For more data circle 504 on Postpaid Card

new equipment . . .

and left hand models in the popular RD (Regular Duty) series, 5½ inch shut-height and 2 19/32 inch die-height or the HD (Heavy Duty) series, 8¾ inch shut-height and 3½ inch die-height. To work with this new series, a complete line of regular duty and heavy duty punching units are also available.

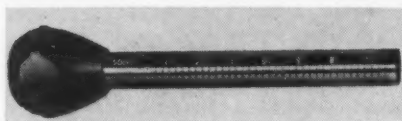
For more data circle 132 on Postpaid Card

★ modern machine shop ★

PLUG GAGE

A taper tenths plug gage has been announced by Olson Industrial Products, Inc., Wakefield, Mass. With this gage, which has no moving parts, the operator is able to read a hole diameter directly to size without removing the gage.

Available in sizes ranging from 0.250 to 1.378 in both stock and special



View shows Olson Taper Tenths Plug Gage

units, the Taper Tenths Plug Gage fills a long felt need in the industry for an accurate, fast, fool-proof tool. For more data circle 133 on Postpaid Card

★ modern machine shop ★

DIE FORMING MATERIAL

ElastaCast, a die forming material that provides a method of forming with the use of a punch or die, has been announced by Standard Die Set Co., Div. of Harsco Corp., 1485 Elmwood Ave., Providence 7, R. I. ElastaCast is a polyurethane material which is offered in three types of compounds in slabs for heavy, medium and light material forming with the use of conventional punches and presses, and in rods for use by expansion in split dies.

ElastaCast when used as a forming material is efficient to the proportion of movement of its mass against the metal blank that is supported by the solid shape (punch or die) in which the dimensions of the finished piece are provided. ElastaCast has a high durometer and is not compressible within two or three percent. However, it moves freely in the transfer of a kinetic type of energy as the punch

Grind Accurate Free Cutting Drills



STERLING "DB" Drill Grinder

True Conical Relief for FREE CUTTING

A fast, versatile, compact drill grinder that accurately sharpens 2, 3 and 4 lip drills. For complete details and low price write for Bulletin "DB" TODAY.

McDONOUGH MFG. CO.

1521 Galloway, Eau Claire, Wisconsin

For more data circle 505 on Postpaid Card

242 MODERN MACHINE SHOP

SAVAGE

NIBBLING MACHINES

- Sheet Metal Cutters
- Roller-Die Type Best for Cutting Stainless Steel
- No Sparks • No Oxidation
- No Secondary Operations
- No Open Flame
- Capacities to ¾"

DEALERS IN MAJOR CITIES
WRITE FOR BULLETIN "K"



W.J. SAVAGE COMPANY

KNOXVILLE, TENNESSEE

For more data circle 506 on Postpaid Card

June, 1961

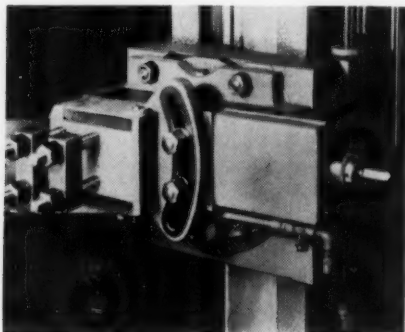
moves into the mass and actively moves the displaced volume above the horizontal plane against the blank supported by the punch. The direction of force is within a range of 70 to 90 degrees to the face of the blank as it is being formed. Resultant pressures are uniform over every square unit area of blank backed up by the punch. The result is forming without changing the gage at any point of the part, nor do draw marks become apparent on the surface of the Elasta-Cast side. Edges consequently are not as sharp even though the punch provides sharp lines. In short, the specific angle is formed but a uniform gage prevails. The material is non-absorbent so that drawing compounds or oils have no effect upon its normal functioning.

For more data circle 134 on Postpaid Card

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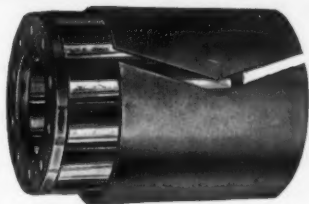
SMALL PLANER WITH COMBINATION OF HEADS

The Flying Scot small planer has been introduced by The G. A. Gray Co., Dept. N 3114, Cincinnati, Ohio, and can be supplied with either single or double cutting heads, or any combination of the two desired. The sad-



Close-up of side head of Flying Scot Planer; any combination of side or rail heads, single or double cutting is possible.

June, 1961



TYPE GC

INDUSTRIAL ROLLER BEARING

STANDARD SIZES ARE SHOWN IN OUR
GENERAL CATALOG SENT UPON REQUEST.
SPECIAL SIZES TO ORDER.

... ALSO METAL BALLS ...

THE GWILLIAM COMPANY

Incorporated 1912

358 FURMAN ST. BROOKLYN 1, N. Y.

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Optional SWIVEL BASE converts a conventional dividing head into a universal work head or rotary table. Change-over is accomplished in seconds without tools or wrenches.

Also available in 10" - 12" sizes and in 10" - 12" spiral drive.

Write for Catalog

CARROLL DIVIDING HEAD CO.

3525 Cardiff Ave. • Cincinnati, Ohio

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MODERN MACHINE SHOP 243

new equipment . . .

dles for both rail and side heads are identical for both single and double cutting heads. Thus, either type of head will fit on the same saddle. For example the Flying Scot may be set-up with one rail head of the single cutting type, and one rail head of the double cutting type. Similarly either type of side head may be used with either type of rail head. Both the rail head and side head of the Flying Scot have virtually the same features. The side head, however, is over-counter-balanced to eliminate "jumping" when entering a cut caused by backlash between the elevating screw and nut.

The rail is sufficiently long to permit the use of two heads. Either can be used independently to plane the width of the machine. Rail saddles are right and left hand so the heads

may run close together. Square lock design rigidly resists the unique forward and reverse thrusts produced in double cutting, and minimizes vibration under heavy cuts. Speed and rapid traverse of the slides is driven by a common shaft in the cross rail. The Flying Scot is powered by a 60/75 h.p. variable voltage drive. The motor is adjusted in the cut and return direction from 180 to 1800 r.p.m. Standard table ratio is 6 to 1, providing table speeds of from 30 to 300 feet per minute. The Flying Scot is available in nine combinations of table widths and heights; basic sizes are 30, 36, and 42 inches.

For more data circle 135 on Postpaid Card

★ modern machine shop ★

CABINET BENCH

Bay Products, Inc., 1827 W. Cambria St., Philadelphia 32, Pa., has introduced a unit which is a convenient bench height storage cabinet with a heavy duty steel top working surface. This working surface is suitable for mounting vises, office machines, small power machines, and so on, and has no raised bolt heads to interfere with work. The storage area underneath has a reinforced center shelf adjustable up or down on 1½ inch centers. Both center and bottom shelves are sturdy enough to permit storage of tools, dies and jigs. Double doors with locking "T" handle protect

surface
harden

TOOLS &
PARTS
without
special
equipment

KASENIT COMPOUNDS

For use in tool rooms and machine shops, Kasenit is deep-penetrating, eliminates soft spots and warping. Absolutely safe, easy to use. Booklet B tells how these compounds can help you. Write now!

Available direct or from leading industrial distributors.

KASENIT CO. 12 KING ST., MAHWAH, N. J.

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NO RE-SETTING, INSTANT ADJUSTING



VIMCO *Lights* SINCE 1919

On the spot machine lights...speed production by cutting down eyestrain and rejects. Custom design, or 6 standard models. Send for Folder 85.

VIMCO MFG. CO., INC., 400 MAIN ST., HOLLAND, N. Y.

For more data circle 510 on Postpaid Card

UL LISTED



View of Bench Height Storage Cabinet Unit

all equipment that is being stored.

Unit is all steel, 36 inches wide by 24 inches deep by 33 inches high to working surface, and finished in gray baked enamel.

For more data circle 136 on Postpaid Card

SEALED LIMIT SWITCH

Virtual elimination of limit switch failure by the application of an epoxy resin to isolate the switch from the entry of moisture has been announced by Electrical Controls Div., The National Acme Co., 183 East 131st St., Cleveland, Ohio. According to the company, the Super Seal Switches are guaranteed for at least 10 million cycles or one year of operation. Seepage of coolants and condensates into switch housing through conduit systems has been cited as a major cause of limit switch failure. However, National Acme's Research and Development Laboratory now says that a marked reduction in equipment downtime is assured by sealing the switch with the thermosetting epoxy resin. The unit is also claimed to be rendered tamper-proof by fastening switch covers to housings with the aid of drive screws.

The material used to seal the switch



INTERNAL CUTTING TOOLS

4 DISTINCTIVE STYLES
IN CARBIDE & HSS

SIZES FROM $\frac{1}{16}$ " UPWARD

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R. B. TOOL CO. INC.

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EDgewood 3-1382



BORING



FACING



THREADING



RECESSING



SOLID SHANK TYPE



DETACHABLE HEAD TYPE

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new equipment . . .

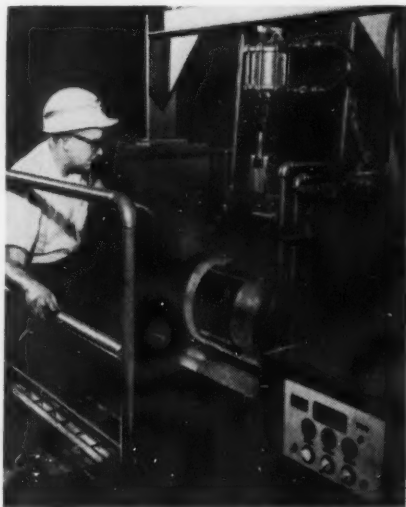
has high dielectric strength, unusual chemical stability including resistance to solvents. It also possesses excellent mechanical properties including high resistance to heat and shock, unusual tensile and compression strengths and a low shrinkage coefficient.

For more data circle 137 on Postpaid Card

★ modern machine shop ★

ROTARY SPOT PRINTER

Jas. H. Matthews & Co., 3948 Forbes St., Pittsburgh, Pa., has announced a rotary spot printer for imprinting cut-to-length galvanized sheets, and other flat products. Called the Matthews Model 5627 Rotary Spot Printer, it enables galvanized sheet producers and manufacturers of other flat products to control the position and number of trade-marks or



Matthews Model 5627 Rotary Spot Printer

imprints desired per sheet. Also, it prints at top line speeds.

The electronically operated printer is mounted over the galvanized sheet conveyor line just before the piler and beyond the roller leveler. It can be installed without interrupting production. Since it is located in the cut-to-length area, it enables producers to trade-mark prime quality sheets only.

The location and number of imprints is governed by a unique electronic control system. And, because the printer is mechanically driven, only the printing die comes in contact



DRILL THESE HOLES
BY A QUICK, EASY, INEXPENSIVE METHOD
Your business letterhead will bring literature.
WATTS BROS. TOOL WORKS
Wilmerding, Pa.

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Complete Facilities For
**CAM MILLING &
CAM GRINDING**
To Your Specifications
CAM SERVICES CO.
DIVISION OF HIMOFF MACHINE CO. LONG ISLAND CITY, N. Y.



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with the sheet surface. The unit eliminates the danger of surface marring or distortion on even the lightest gauge sheets.

The unit's ink system employs a pump to keep ink continuously circulating and free flowing. To minimize maintenance and attention, an automatic viscosity control system may be added.

The printer features push-button control which converts the unit to "spot" printing or continuous printing, as desired. The Matthews Model 5627 weighs 1200 pounds and stands 37 inches high. It is 46 inches wide and 41 inches long. Drum diameter to face of die is 18 inches.

For more data circle 138 on Postpaid Card

★ m m s ★

PROTECTIVE HEADSHIELDS

The Lincoln Electric Co., Cleveland 17, Ohio, announces the addition of a



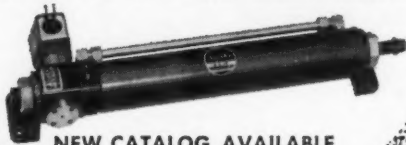
Lincoln Coolshield Welding Helmet

series of protective headshields to its line of welding supplies. Protection, comfort, convenience, and durability are performance features claimed for the Lincoln Coolshield welding helmets. Four styles of the fiberglass and polyester resin molded Coolshield provide a wide range of helmet shape to accommodate varying physical proportions of welders and different working conditions. Pliable thermoplastic headgear easily adjusts to exact head



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YOU WOULDN'T
RACE THIS at
DAYTONA
BEACH...**

BUT WHAT DO YOU KNOW ABOUT AIR CYLINDERS?



NEW CATALOG AVAILABLE
Write Before Next Tuesday



MMS-6

ALLEN AIR CORP. 255 EAST 2nd ST., MINEOLA, N. Y.

Name.....

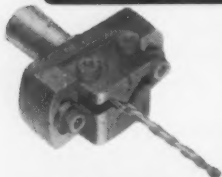
Company.....

Address.....

City.....Zone.....State.....

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ACCURATE SET-UPS FAST!



Accurate, rapid set-ups the first time, every time... is the reason Brookfield Tool Holders are now widely used in practically every metalworking plant in the country. With one Brookfield Tool Holder, you can cut your stock of bushings by at least 100. Here's why:

BROOKFIELD TOOL HOLDERS

- **ADJUSTABLE V JAW** holds wide range of tool diameters without bushings or accessories.
- **AXIALLY TRUE DESIGN** makes perfect tool alignment almost automatic.
- **BALANCED-PRESSURE LOCKING ASSEMBLY** maintains uniform seating, eliminates creep or shift.
- **EASY TO USE** — just slip tool in the jaw, tighten, then float tool into dead center and lock.

AVAILABLE IN A WIDE RANGE OF SIZES

MODEL NO.	HOLDING RANGE	SHANK DIA.
BA-10	1/8" - 1/2"	3/4"
DA-10	1/8" - 1/2"	1/2"
DA-12	1/8" - 1/2"	3/4"
GA-12	1/8" - 1/2"	1/2"
GA-16	1/8" - 1/2"	1"
KA-16	1/8" - 1"	1 1/2"
KA-24	1/8" - 1"	1 1/2"
PA-24	1/8" - 1 1/2"	1 1/2"
PA-28	1/8" - 1 1/2"	1 3/4"

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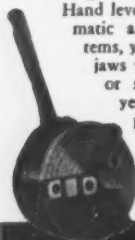
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LABOR SAVING Production CHUCK

Will pay for itself in 60 to 90 days

On turrets, engine lathes, cutting-off machines, drill presses or any type of chucking machine, the Barker Two-Jaw or Three-Jaw hand operated chuck will increase production up to one third and actually pay for itself while doing it in from 60 to 90 days.

Hand lever eliminates pneumatic and hydraulic systems, yet closes and locks jaws with lathe running or stopped. Over 30 years of labor saving, production boosting operation.



Hand lever closes and locks while lathe is running.



Jaws locked

Write for bulletin 201 today.

CHUCK DIVISION

THOMAS HOIST CO.

28 S. HOYNE • CHICAGO 12, ILL.

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248 MODERN MACHINE SHOP

new equipment...

size and forms itself to exact head shape, assuring welder comfort.

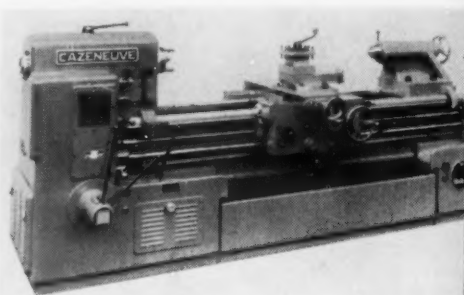
A lightproof, durable, metal lens holder prevents shock breakage of the lens. A flip type holder is available on one model shield to permit weld inspection and cleaning without moving the entire helmet. Adjusting mechanisms, including headgear stop positions and ratchet size adjustment, are designed for quick positive action. The tough shell will not warp when exposed to heat or moisture. Additional strength to resist breakage and withstand abuse is gained from the reinforcing beading around the shield edges.

For more data circle 139 on Postpaid Card

★ modern machine shop ★

TRACER LATHE WITH FOUR-WAY TOOL TURRET

Cazeneuve Lathes, Inc., 549 East Linden Ave., Linden, N. J., announces the availability of its HB 725 tracer lathe which is powered with a compact, quiet running 22 h.p. motor with a multiple V-belt drive, giving adequate power under all conditions. The HB 725 comes equipped with a four-way tool turret which is accurate to 0.0005. The tracer will repeat within



View shows Cazeneuve HB 725 Tracer Lathe

June, 1961

0.0004. It is equipped with a stylus ideally suited for all tracing work.

Designed for highly precision, accurate operation, all shafts are mounted on anti-friction bearings. Lead and cross feed screws are ground for accuracy and smooth performance. All moving parts are automatically pressure lubricated to insure maximum efficiency.

For more data circle 140 on Postpaid Card

★ modern machine shop ★

COOLANT SUMP CLEANER

Pumping rate for removing coolant, chips, and sludge from machine tool sumps has been increased 30 percent in the redesigned CeCOR DLO Coolant Sump Cleaner, manufactured by Coolant Equipment Corporation, Verona, Wisconsin. From 10 to 20 gallons of coolant, chips, and mud can be removed per minute. Less man hours for machine tool maintenance are



View shows Model DLO Coolant Sump Cleaner

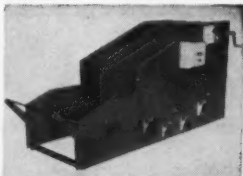
immediately apparent with the CeCOR DLO since it is no longer

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economically priced
PRESS ROOM
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17 Thurbers Avenue
Providence 5, Rhode Island



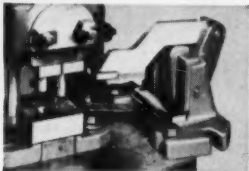
ROLL FEEDS, 17 Models from \$150.



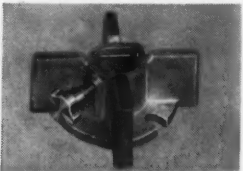
COIL CRADLES, 40 Models from \$285.

Write for new, free catalog detailing a complete selection of Wire and Stock Straighteners, Die Set Pullers, Stock Oilers, Stock Reels, and Motor Driven Scrap Choppers . . . Over 100 necessary pieces of equipment for the modern press room.

*Our nearby
representatives will
be pleased to be
of service to you
without
obligation.*



PRESS RAM SCRAP CHOPPERS, 5 Models from \$69.



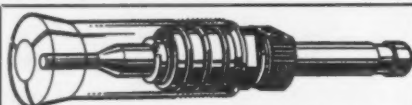
TOOL and DIEMAKER'S PUNCH HOLDERS, only \$19.50

For more data circle 517 on Postpaid Card

new equipment . . .

necessary to skim the liquid from the top of the coolant tank and finish off with hand shoveling the residue. Ultra high suction, 275 inches water, makes it possible to thoroughly remove slurried coolant mud and chips.

The most abrasive material can be



NEW! Self-Centering 5C Collet Stop

Quick friction adjustment. Stays in fixed position. Will not distort collet. Will not move back. Also available for other collets and spindles. 30 days Free Trial. Several Territories Open for Distributors.

Write for Bulletin

THE BYSTROM COMPANY

6106 Park Ave. So. Minneapolis 17, Minn.

For more data circle 518 on Postpaid Card

IMMEDIATE DELIVERY!

KNOBBS LEVERS WHEELS & HANDLES

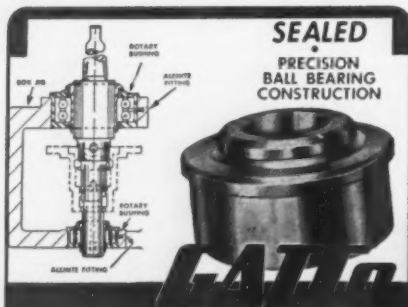


Cadmium plated, large selection of styles and sizes. Specials on request. Send for FREE catalog.

MACHINE PRODUCTS Corporation

6771 E. MICHIGAN ROAD • DETROIT 12 MICHIGAN

For more data circle 519 on Postpaid Card



For more data circle 520 on Postpaid Card

handled without pump wear since the vacuum principle employed draws the sump contents directly through the hose into the drum. The unit operates on 110 volt, 60 cycle, single phase electrical circuits, with automatic overfill control, vacuum relief valve, 10 foot reinforced neoprene suction hose and nozzle. The compact pumping equipment is mounted on a self-sealing lid which fits standard 55 gallon drums.

For more data circle 141 on Postpaid Card

★ modern machine shop ★

MAGNETIC FORCE WELDER

Precision Welder and Flexopress Corp., 3522 Ibsen Ave., Cincinnati, Ohio, has announced that PVA-1 standard welders are offered in 20, 30, 50 and 75 kva. Models. These magnetic force machines are primarily designed for production welding of critical materials, heretofore difficult to weld. Such combinations include welding silver tungsten to brass, stainless to brass, and copper to copper.

Magnetic force welders employ an electromagnet, energized by the weld current, to coordinate weld heat and forging pressure more precisely. These units can also be furnished with magnetic force delay to further refine weld force timing. Magnetic system components are fully visible and accessible through the Plexiglas door provided on the front of the cabinet.

ROTARY BUSHINGS

FOR DRILLING, CORE DRILLING ROUGH AND FINISHED BORING

The inner race of the GATCO bushing rotates with the tool, piloting the tool accurately below or above the work - or both.

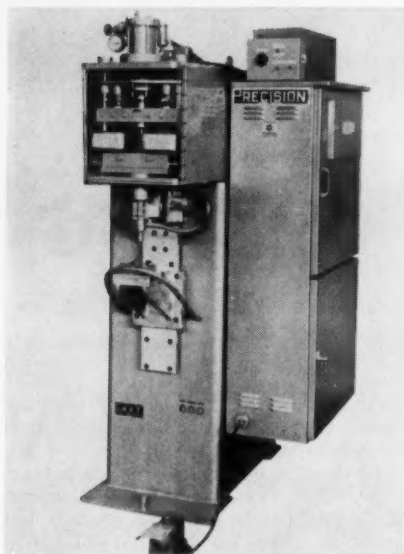
Eliminates expensive tool construction - Reduces tool wear - Prevents seizure and pilot breakage - Especially adapted where precision is required.

Write for full information and prices

ROTARY BUSHINGS

42336 ANN ARBOR ROAD PLYMOUTH, MICH.

Telephone GLENview 3-2295



Precision PVA-1 Magnetic Force Welder

The PVA-1 Models are all based in cabinets 20 inches by 36 inches by 64 inches. A 20 kva. Bench Model, PVB-1, and larger standard PVB-2 Models of 100, 150, 200 and 250 are also available.

For more data circle 142 on Postpaid Card

★ modern machine shop ★

HOLE PUNCHING UNITS

A complete line of Unipunch Series HZ Horizontal Hole Punching Units has been announced by Punch Products Corp., 370 Babcock St., Buffalo 6, N. Y. The Unipunch Series HZ Hole Punching Units are designed for punching round and shaped holes in flanges of angles and other formed parts. The punch in this type unit travels horizontally and the button type die, stripper spring, lifter spring, and guide are located in a horizontal position in the holder. Nothing is attached to the press ram. The holder of these completely self-contained

another VICTOR value!

DIAMOND WHEEL DRESSERS

TOP QUALITY • LOWEST PRICES

Made of selected, full individual stones, mounted in 7/16" diameter x 6" long cold rolled shank.

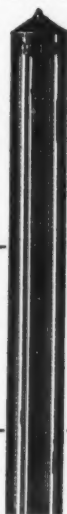
Karat	Regular Price	Our New Price
1/4	\$ 6.00	\$ 2.85
1/2	12.00	5.00
3/4	21.00	7.50
1	30.00	10.25
1 1/2	54.00	15.00
2	75.00	20.00
2 1/2	102.00	26.00
3	130.00	32.00

These diamonds can be set in any shank to your specifications for \$1.00 each extra.
Order Today —

Immediate Shipment from Stock!

VICTOR MACHINERY EXCHANGE, INC.

Tool Room Equipment Since 1918
DEPT. M, 251 CENTRE STREET
NEW YORK 13, N. Y. • TEL.: CAnal 6-5575



For more data circle 521 on Postpaid Card



New! Improved! FLY-TOOL CUTTER HOLDER

- COST SAVER
- TIME SAVER
- DURABLE
- EFFICIENT
- CAPACITY:

3 convenient sizes with 3/4" shank and stand used with 5/16" carbide or high speed tool bits. Will machine up to 6" wide surface.

NEW counterbalanced model allows faster speeds and feeds. Made of steel—hardened. Save on expensive end mills and sharpening costs. Better finishes.

Write for Bulletin. Dealers invited.

CITY TOOL DIE & MFG CO.

132 Spencer Avenue San Jose 10 California

For more data circle 522 on Postpaid Card

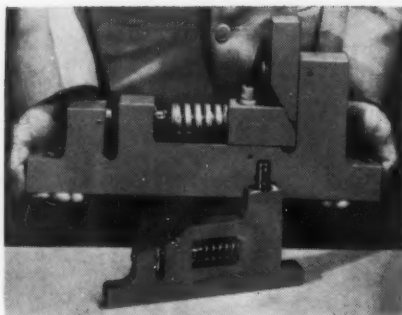
MODERN MACHINE SHOP 251

\$39.50
SET OF 3

new equipment . . .

units accurately align the punches and dies.

In operation, the press ram depresses wedge-shape vertical plunger down to move the beveled punch block against the punch head. In this way the punch horizontally pierces the work. By setting up a group of these



Unipunch Series "HZ" Hole Punching Unit

SWISS INDICATOR #1-D

Now sold under the name INTERAPID. Stem cap adjusts 0 position. Stationary dial. (0 always at top of instrument.) Forged steel case. A.G.D. standard.

—Dealer inquiries invited—

BOREL & DUNNER, INC.

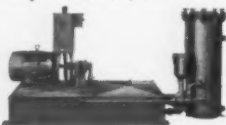
19313 Farmington Rd., Livonia, Mich.



For more data circle 523 on Postpaid Card

GUN DRILLING HYDRAULIC UNIT

Both high and low pressure pumps and tanks; proper G.P.M. for job. Large filter unit, 5 micron. Pushbutton station. Avey Division, Cincinnati 1, Ohio.



For more data circle 524 on Postpaid Card

Unipunch Series HZ Hole Punching Units on a template, round and shaped holes can be punched in all vertical sides of a box at each stroke of the press ram. Pilot pins extending below the holder base accurately locate these units on a drilled mounting template.

Unipunch Series HZ Hole Punching Units are available in a complete range of holder widths up to 2 inches for punching up to $\frac{1}{4}$ inch mild steel.

For more data circle 143 on Postpaid Card

★ modern machine shop ★

BOOTED UNIVERSAL JOINTS

Lovejoy Flexible Coupling Co., Chicago, Ill., has introduced a line of booted universal joints, especially developed for severe service applications. These include: heavy loads,

*You Need an Extra Hand Now
to Speed Up Production!*

HEIMANN TRANSFER SCREW SETS

IN 11 SIZES—No. 6 to 1"
N.C. in all S.A.E. sizes.



Here is the faster, more precise way of transferring open and blind screw holes—make savings in "wage-dollars-per hour" of your expensive hands on every job. A die-and-tool maker's tool with many other applications for die makers and machinists. A set of 6 Hardened Screws nested in combination holder and wrench—no other tools needed. Get more work now—save money tool

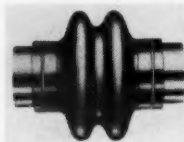
HEIMANN MFG. CO. • URBANA, OHIO

For more data circle 525 on Postpaid Card

high speeds and/or high heat; contact with dust, dirt and other contamination; and any situation where lubrication with oil is difficult or impossible.

The joints are fitted with oil-resistant Neoprene covers which allow them to be pre-packed with grease. The cover or boot is held firmly in place by snap wires and can be quickly and easily removed or replaced in the field. It in no way affects performance of the joint, allowing operation through a full 40 degree working angle.

The line incorporates both standard and heavy duty types. Standard duty booted joints are available from $\frac{3}{8}$ to $2\frac{1}{2}$ inch o.d., with static torque range from 220 to 30,000 inch-pounds, horse-powers from 0.35 to 120 and speeds to 1500 r.p.m. Heavy duty booted joints come in the same o.d.'s, static torque range from 540 to 48,000 inch-pounds, horse-powers from 0.86 to 230 and speeds to 1750 r.p.m. Metallurgi-



Lovejoy Booted Universal Joint

June, 1961

cal construction is case hardened stainless steel alloy, with an option of various grades of steel and bronze bushings surrounding the pin available for some sizes in both types.

For more data circle 144 on Postpaid Card

★ modern machine shop ★

TOOL BITS

A series of tool bits, designed for exceptional wear resistance and long life, has been introduced by Morse



Consider the Advantages of Sentry

For tool room or production line, Sentry Furnaces with the Diamond Block Atmosphere offer a combination of advantages for hardening high speed, air hardening, and high carbon high chrome steels.

- | | |
|---|---|
| 1. Positive hardening control. Neutral atmosphere automatically maintained. | 3. Tool spoilage eliminated. |
| 2. Simple to operate. Unskilled operator produces quality results consistently. | 4. Finishing operations eliminated. |
| | 5. Absolutely safe and harmless. |
| | 6. Low initial investment plus operating economy. |

The greatest advantage: better tools for uninterrupted production.

Sentry

TRADE MARK

ELECTRIC FURNACES

Request Catalog! 2K Write THE SENTRY CO., FOXBORO, MASS.

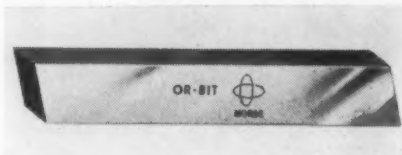
For more data circle 526 on Postpaid Card

MODERN MACHINE SHOP 253

new equipment . . .

Twist Drill & Machine Co., New Bedford, Mass. Known as the "Or-Bit" series, the line is available in two types of steel, both of which are ideally suited for general purpose work in most materials as well as for cutting heat treated steels and other high-tensile-strength materials.

The Or-bit IV series is made from



View of Morse Series "Or-Bit" Tool Bits

an M-4 high speed steel composition which combines outstanding abrasion resistance with high edge strength to withstand the shock of intermittent cuts. The bits are available in regular flat and square sizes, either ground or "Form Finished." Or-bit IV Form Finished Tool Bits have a clean, smooth, accurately sized finish, free from scale or pits.

Or-bit XV tool bits are made from a type of cobalt steel capable of being treated to an unusually high hardness.

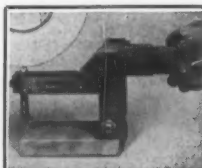
They are especially well suited for machining high-tensile-strength materials, such as heat-treated steels, and for resisting the abrasion encountered in cutting hard cast iron, cast steel, aluminum, brass, and plastics. In addition, they will cut ordinary materials at speeds from 15 percent to 100 percent faster than average.

For more data circle 145 on Postpaid Card

★ modern machine shop ★

FLUID TRANSFER UNIT

An improved version of its original fluid transfer unit has been announce-



Low Price—\$149.50
Includes Diamond

NEW 1961 MODEL "SS" RADIUS DRESSER

Newly engineered and redesigned after 19 years of field testing. Convex, concave, or complex combination shapes are dressed quickly and easily by even inexperienced operators. Accuracy to .0002". Dresses all wheels up to 12" diameter.

Write today for free illustrated folder.

SOMERSET TOOL CO. 320 Virginia St.
Hillside, N. J.

For more data circle 527 on Postpaid Card

CUTTER SHARPENING

END MILL
THRU 1/2" DIA.

60c

PER END

SHELL END MILLS

2"	2.00
2 1/2"	2.50
2 3/4"	2.75
3"	3.00

Equally low prices on other sizes.

NO EXTRA CHARGES

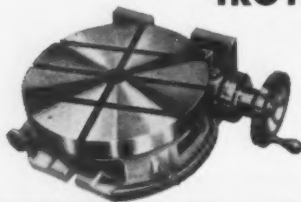
GOLDEN STATE TOOL CO.
106 W. THIRD ST. RM. 304
LOS ANGELES 13, CALIF.

For more data circle 528 on Postpaid Card

TROYKE ROTARY TABLES

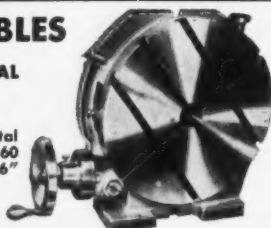
HORIZONTAL AND VERTICAL

SIZES 9" - 25"



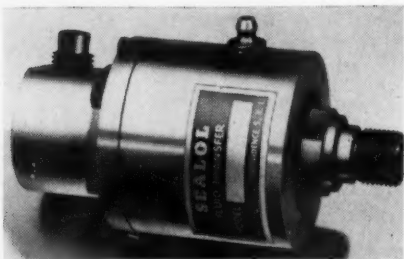
Guaranteed 60 seconds or less total accumulative angular error. (60 seconds equals .00087" at 6" diameter.)

Write for Catalog 23A



TROYKE MFG. CO. • 11296 ORCHARD ST., CINCINNATI 41, OHIO

For more data circle 529 on Postpaid Card



View shows Sealol Fluid Transfer Unit for use with hollow shafts or spindles

ed by Sealol, Inc., Providence, R. I. The unit will withstand cycling or steady pressures to 1,200 p.s.i. at rotational speeds to 12,000 r.p.m., an increase of 20 percent in both pressure and speed capabilities according to the company.

Applications for this unit include gundrill, clutch, power cylinder and similar uses calling for transferring fluids from a stationary source to a rotating hollow spindle.

For more data circle 146 on Postpaid Card

★ modern machine shop ★

10 INCH PRODUCTION LATHE

Pratt & Whitney Co., Inc., West Hartford, Conn., has announced a 7½ h.p. production lathe that is accurate to toolroom tolerances and produces exceptionally fine finishes at production line speed. It can take heavy cuts, as well as the most delicate cuts on frail workpieces. Repeat diameters are picked up quickly and easily.

The P&W SIM Lathe is especially designed for economical, efficient operation in small and medium job lot turning operations. Power to remove metal fast, at speeds up to 2,800 r.p.m., is provided by the 7½ h.p. motor. The right speed and feed for any type cut in any type material is allowed by 9 forward and reverse speeds and 9 longitudinal and cross slide feeds. The desired length of cut is automatically

4 Reasons why you should use

GAMMONS DIE REAMERS

✓ Specially treated for today's modern die steels.

✓ Rapid cutting capacity.

✓ Tapers per inch .005, —.008, —.013 in stock.

✓ Large range of standard sizes in stock at all times for your convenience.

WRITE FOR COMPLETE INFORMATION

GAMMONS • HOAGLUND CO.

MANCHESTER 2, CONN.
Manufacturers of helical taper pins, chucking, die makers and special reamers

For more data circle 530 on Postpaid Card

MODERN MACHINE SHOP 255

new equipment . . .

obtained by micrometer adjusted carriage slide stops which trip the power feed to the carriage at any desired location. Repeat diameters are picked up quickly and easily by selecting a preset cross slide stop.

More production speed and effi-

Accurate Hole Transfer Made Easy With **NIELSEN TRANSFER SCREWS**

Simply insert in holes, invert, strike sharply and you have centers and drill circles perfectly located. Reduce time and eliminate spoilage of other methods. 8 sizes, from $\frac{3}{16}$ " to $\frac{3}{4}$ " U.S.S. Inexpensive — Last for years.



Write for Circular
**NIELSEN TOOL &
DIE COMPANY**
17336 Lahser Road
Near Grand River
Detroit 19, Michigan

For more data circle 531 on Postpaid Card

TAKING CHANCES WITH **WORN SURFACE PLATES?**

WE RESURFACE ANY
MAKE GRANITE PLATE.

— **5-DAY SERVICE** —
ACCURACY GUARANTEED.

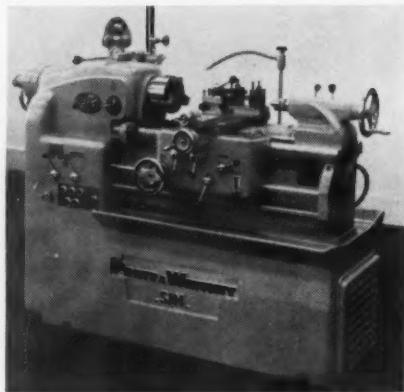
awley

INSP. GRADE \$10.00 ☐
LAB. GRADE \$15.00 ☐

GRANITE SURFACE PLATE CO.

WYOMING, PA.

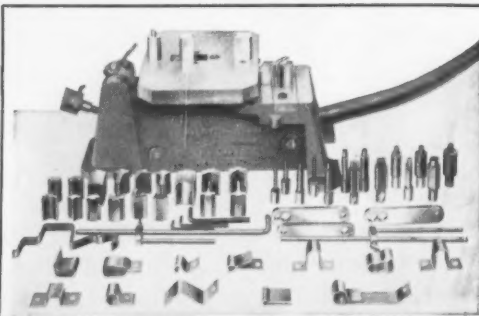
For more data circle 532 on Postpaid Card



View shows P & W SIM T-5 10 inch Lathe

ciency result from the ability of the spindle to run clockwise or counter-clockwise at all spindle speeds, and quick reversing with a full range of reverse speeds allows full utilization of the rear tool post without chatter. Because the reversing feature, the tendency to lift tools from the rear cross slide is eliminated and there is no need for "down time" and "set up" to turn tools upside-down.

Longer life of the machine is assured by such built-in features as a lubrication system which automatically lubricates all main units; hardened and ground chromium-nickel gears throughout; case hardened and ground steel carriage ways of the inverted



Multiform

BENDER CUTTER

Users report the Multiform Bender one of the handiest tools in the shop. No special tooling . . . Bends, Cuts, Punches, Flats, Rounds into Any Shape, Brackets, Springs, Busbars, Wire Forms, Aircraft Work, and Steel Rule Dies for Metal Blanking.

**AIR OR HAND MODELS FOR UP TO
1/4" to 4" MATERIAL**

Write for brochure which illustrates
and describes the four bender models.

J. A. RICHARDS CO.

Dept. 6-M

Kalamazoo, Mich.

For more data circle 533 on Postpaid Card

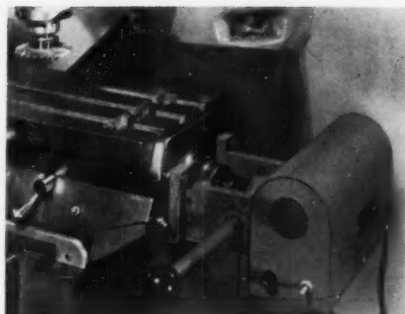
"Vee" type, hardened spindle and hardened tailstock quill to resist wear; a power meter which registers the power being consumed at any instant and protects from overloading and indicates any dulling of the cutting tool.

For more data circle 147 on Postpaid Card

★ modern machine shop ★

POWER ATTACHMENT

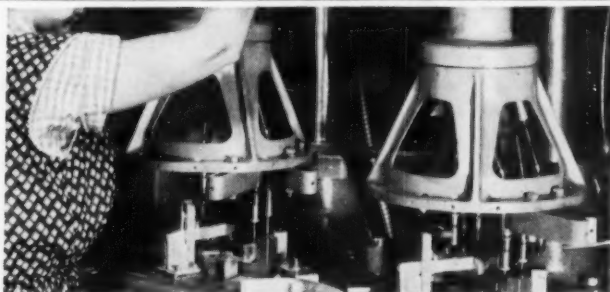
M & M Tool & Mfg. Co., 1123 East Third St., Dayton 2, Ohio, has introduced a power attachment for hand operated machine with a slip clutch added to protect motor drive and to allow machine to drive up to a stop. A special limit switch can be added to reverse motor. The unit can be attached to rotary tables, vertical mills, grinders and other equipment that require power feeds. The unit is equipped with a 110 volt, 60 cycle motor with variable control.



View shows M & M Rotor Power Attachment

The M & M Rotor Power Attachment reduces human errors when machining parts that require more accurate machining. The operator is free to work on deburring or other work while the machine is cutting. A special feature allows quick hand operation when power is not needed. For more data circle 148 on Postpaid Card

**Makes
any
drill press
a HIGH**



PRODUCTION TOOL in minutes!

With a MULTI-DRILL, you can go from hole-at-a-time drilling to real production in a matter of minutes! That's all the time it takes to mount any one of the many standard MULTI-DRILL adjustable multiple spindle drill press attachments on any drill press and put you into time and money-saving multiple drilling. Every MULTI-DRILL is quickly adjustable to drill a variety of hole patterns. Every MULTI-DRILL is designed for high production work. To learn how you can profit with a MULTI-DRILL, ask your nearby Commander Distributor to show and demonstrate the unit that meets your job requirements.

109

Commander MFG. CO.

4224 WEST KINZIE

CHICAGO 24, ILLINOIS

For more data circle 534 on Postpaid Card

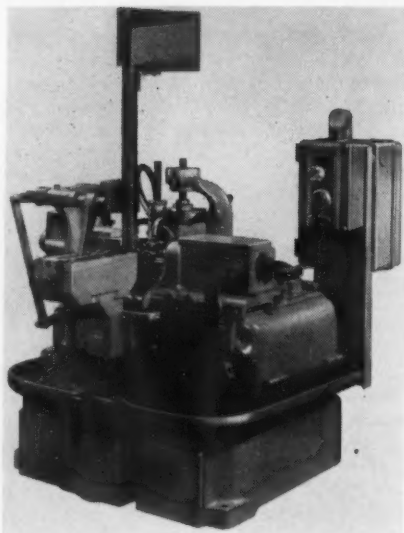


Write for the
Production Tool Catalog

new equipment . . .

GEAR HOBGING MACHINE

Barber-Colman Co., Rockford, Ill., has announced a gear hobbing machine with shuttle-type loading and complete automation and with speeds up to 4084 r.p.m. for fast, high-volume production of small, fine-pitch instru-



Barber-Colman No. 1 1/2 Hobbing Machine



CARBIDE CONTACT POINTS

Precision made for all popular make indicators
.015 — .031 — .062 — .100

\$3.50 each

JACOBS CARBIDE POINT CO.

1101 E. Stroop Rd. • Dayton 29, Ohio

For more data circle 535 on Postpaid Card

FLUTED TOOLS

Cutters • Millers • Taps • Reamers

MADE AUTOMATICALLY

Economically from Solids

Get details on Miller and Grinder



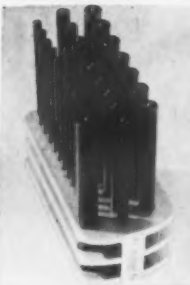
WARDWELL Mfg. Co.

3803 Ridge Rd., Cleveland 9, O.

For more data circle 536 on Postpaid Card

ment gears. The No. 1 1/2 can perform all handling and hobbing operations on small spur gears, pinions, and special tooth forms at rates higher than 1000 per hour.

The hobbing machine is equipped with antifriction workslide and hob spindle. All shafts run in needle bearings. Accurate tooth forms can be produced in seconds, hobbing brass, aluminum, phenolic, and other materials in the same machinability range. Automatic cycle can include feeding,



SPELLMACO 'SPOTTERS'

**A matched set of transfer punches
for toolmakers, machinists and tool cribs**

Used for transferring location of threaded, drilled
and reamed holes, slugs, blanks, etc.

Precision made of finest tool steel—Carefully heat treated and tempered for long life—.0025 undersize to facilitate use—Black oxide finish.

SET #3-17; 28 punches with indexed stand—sizes 3/32" to 1/2", by 1/64"—plus handy 1 1/2" size. Length 4 7/8". ONLY \$19.40.

Single sizes available

R. L. SPELLMAN CO. • URBANA, OHIO

For more data circle 537 on Postpaid Card

holding, clamping, driving, hobbing, deburring, and ejecting.

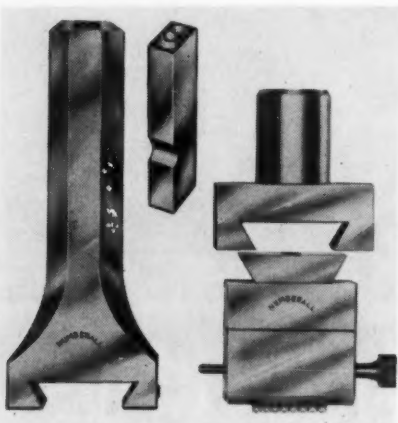
The machine can cut gears as fine as 268 pitch with consistent, high accuracy. Precision adjustments are provided for shifting and setting the hob. Maximum work capacity is 1 inch diameter by $\frac{1}{2}$ inch face, from 24 d.p. in brass and 36 d.p. in steel. For more data circle 149 on Postpaid Card

★ modern machine shop ★

TYPEHOLDER WITH DOVETAIL ADAPTER

Numberall Stamp & Tool Co., Huguenot Park, Staten Island, N. Y., has announced a hand or press typeholder with dovetail adapter, for stamping metal and so on. The dovetailed units allow for speedy changes without disturbing set-ups. The holder can be changed from press to hand stamping in seconds. The typeholder is easily and quickly loaded. A sturdy pin holds type securely; no screws or springs are used. The holder is available with super-quality steel type in various sizes.

For more data circle 150 on Postpaid Card



View shows Numberall Hand or Press Typeholder, with dovetail adapter for stamping.

June, 1961



NEW LINCOLN 225-AMP WELDER PERFECT FOR SMALL SHOP!

Here's a welder that can save time and earn dollars for you. With it you can do just about everything—weld mild and stainless steels, cast iron; braze; solder; thaw frozen pipes; hardsurface. Full 225-amp output lets you handle large $\frac{3}{16}$ " electrodes, big jobs, fast. It helps you hustle work through your shop quickly and efficiently.

Only Lincoln makes this welder which sells for less than \$200 and which will burn $\frac{3}{16}$ " electrodes. Costs less than many 180-amp welders.

WANT DETAILS?

Send for new bulletin No. 4610.1. Describes machine and accessories, production and repair uses. Write today. The Lincoln Electric Company, Dept. F-2441, Cleveland 17, Ohio.



LINCOLN
WELDERS

The World's Largest Manufacturer of
Arc Welding Equipment and Electrodes
For more data circle 538 on Postpaid Card

MODERN MACHINE SHOP 259



**FOR PRECISION HOLDING POWER
DAY-AFTER-DAY, YEAR-AFTER-YEAR
YOU CAN DEPEND ON**



**TOGGLE
CLAMPS**



Contour checking fixture with De-Sta-Co clamps provides a quick check of the accuracy of parts against a master template.



**FOR MORE FACTS
WRITE FOR NEW
36-PAGE CATALOG**



PRODUCTION
DETROIT STAMPING COMPANY

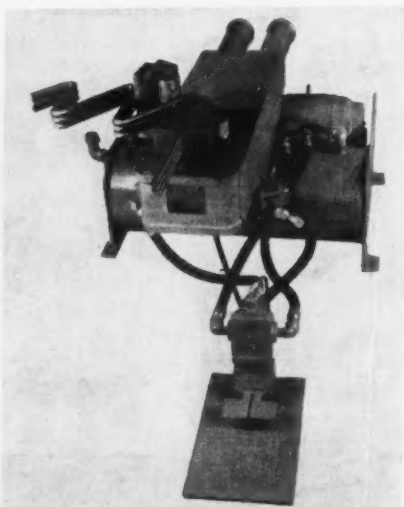
new equipment . . .

**OPEN WEB JOIST AND
STIRRUP BENDER**

Wallace Supplies Mfg. Co., 1304 West Diversey Pkwy., Chicago 14, Ill., announces a bending machine used for bending the web in the steel joists used to support floors and roofs in building construction; also the stirrups used to support the joists.

The bender drives under full power both clockwise and counterclockwise. It is operated by one hydraulic foot valve, permitting the operator full use of his hands for positioning the work prior to bending.

Two adjustable stops for clockwise



No. 35 Open Web Joist and Stirrup Bender

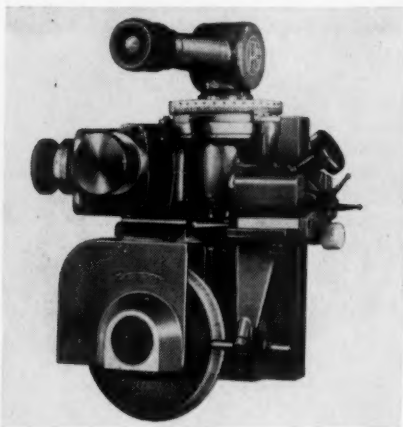
and counterclockwise bending are supplied. The degree of bend called out is set and remains constant for repetitive bending.

For more data circle 151 on Postpaid Card

★ modern machine shop ★

ATTACHMENT DRESSES GRINDING WHEELS OPTICALLY

An optical attachment for fast, precise dressing of grinding wheels has been announced by The Parker-Hartford Corp., 650 Franklin Ave., Hartford, Conn. Called Optidress, the attachment can be permanently mounted to practically any standard surface or tool and cutter grinding machine. It eliminates the need for templates and requires no set up between grinding and re-dressing as the attachment remains on the machine.



View shows Optidress, an optical attachment for precise dressing of grinding wheels.

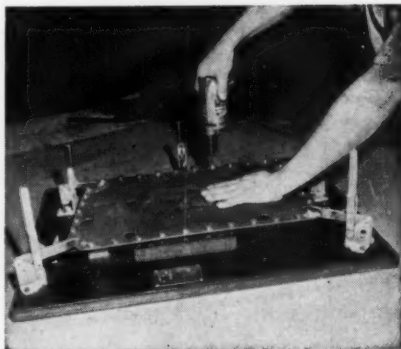


FOR POSITIVE HOLDING OF COMPONENTS IN JIGS AND FIXTURES . .

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TOGGLE
CLAMPS



Simple drilling fixture made up of 5 toggle action clamps mounted on a plywood base holds drill bushing plate firmly in position.

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IMPROVEMENT PRODUCTS

340 MIDLAND AVENUE

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June, 1961

MODERN MACHINE SHOP 261

new equipment . . .

Optidress has a built-in 10X microscope with a radius reticle and a 6 minute vernier for accurately setting the diamond. Radius and two tangent angles may be dressed in a continuous motion in a matter of minutes. Micrometer cross slides are provided to permit the dressing of any combination of radii and angles into an intri-

cate form on the wheel. The optical control eliminates "cut and try" methods and assures a perfect blend between radii and angles.


For more data circle 152 on Postpaid Card

★ modern machine shop ★

9 INCH TWO-WAY ROTARY TABLE

Nichols-Morris Corp., 76-H Mamaroneck Ave., White Plains, N. Y., has introduced a 9 inch two-way rotary table, which is designed to allow either horizontal or vertical mounting. The right-angle base is a high-strength semi-steel casting, stress-relieved, and having both faces ground to insure trueness when used in either horizontal or vertical position. The worm-wormwheel ratio is 90:1. The one-piece worm and shaft, made of alloy steel and ground all over, is run-in with the precision hobbled wormwheel for perfect mating. Adjustment is provided to eliminate backlash. To facilitate set-ups, the worm and wormwheel may quickly be disengaged for free-wheeling.

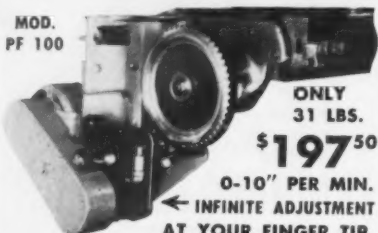
The table circumference and the handwheel dial are graduated to allow settings in degrees and minutes. Graduations are accurately cut and easy to read. A crank indexing attachment is available optionally, providing for all divisions up to 100, with floating index plate and graduated holder

MAGNETIC BASE TOOL HOLDER	21 MAGNETIC TOOLS	11 PERMANENT MAGNETS— VARIOUS SIZES AND TYPES
<p>Indicator Holder — 1/4" dia. non-magnetic stainless steel rod complete with 5/16" and 3/8" O. D. bushings. Fine precision adjustment identical to surface gage. Hardened ball socket setting permits universal positioning. Powerful 50-lb. pull magnetic base insures firm grip on any ferrous surfaces, curved or flat.</p> <p>Write for Catalog #958-A CULLEN MFG. CO., INC. 1603 Washington Ave., Racine, Wis.</p>		 <p>Model 200B—\$6.95</p>

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31 LBS.
\$197⁵⁰

0-10" PER MIN.
← INFINITE ADJUSTMENT
AT YOUR FINGER TIP
ZERO MAX DRIVE

ALSO RAPID TRAVERSE UNIT
FOR BRIDGEPORT \$87⁵⁰

35 LBS. WITH COLLET RACK



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(see our insert in Sweet's Machine Tool file or)

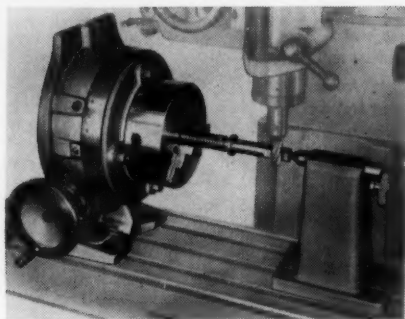
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Lennox Tool & Machine Builders

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Nichols-Morris 9 Inch Two-Way Rotary Table

which greatly simplifies setting-up of work. When used in horizontal position, overall height of the table is only $3\frac{3}{4}$ inches. When used in vertical position, the rotary table will swing work up to 14 inch diameter. Tailstock and fitted chucks are available as extra equipment.

For more data circle 153 on Postpaid Card

THREE CYLINDRICAL DIE THREAD AND FORM ROLLING MACHINE

Reed Rolled Thread Die Co., 791 Main St., Holden, Mass., has announced that higher production rates are now possible with the Model A22 three cylindrical die thread and form rolling machine. A high speed oscillating head is available with the standard A22 machine for production rates of up to 60 pieces per minute. These higher production rates have been made possible through the use of aluminum in the cam actuated oscillating head. This represents approximately 40 percent less weight in the complete head assembly. The cam lever return unit has been redesigned to accommodate this higher rate of oscillation including changes in the spring assembly and housing. This heavy duty cam lever unit maintains contact of the cam roll on the cam at high speeds.

A new cam contour has been de-

high speed sheet polishing

Pneumatic abrasive belt tensioning. Constant through feed using CURTIS-originated conveyor belt principle. Simplified single control stock thickness adjustment — all features of the Model 150 CT. Designed to produce better finishes at higher speeds and at lower cost . . . on any flat metal surface.

For your copy—Model 150 Brochure write to: Curtis Machine Division, The Carborundum Company, Niagara Falls, N. Y.

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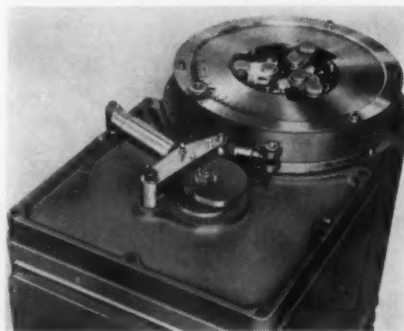
MODEL 150 CT
Abrasive Belt Polisher

For more data circle 543 on Postpaid Card

new equipment . . .

veloped for smooth operation of the head at the higher rates of 50-60 cycles per minute. The cam provides positive action and control for optimum rolling conditions based on preferred penetration rates and work revolutions.

High speed work handling equipment for a wide variety of parts is



View of Reed Model A22 Three Cylindrical Die Thread and Form Rolling Machine

available for operation at these higher production rates. The actual production rates depend not only on the material and size of thread or form to be rolled, but also the shape and weight of the work which may determine the handling time.

These higher speeds have been accomplished maintaining the proven Reed three die principle. This principle provides self-centering of the work between the three dies eliminating the need for separate equipment to position or support the work relative to the axis of rolling. The work rotates about its own axis inherently providing excellent control of roundness. Hollow work or thin walled work can be successfully rolled using the Reed three cylindrical die principle. For more data circle 154 on Postpaid Card

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TOOL
COSTS**

broken tools
made like new again
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Twisted or broken tangs replaced at low costs on any tool with a Morse Taper (sizes 1 to 6). Hundreds of leading industries save money on drills, reamers, countersinks, cutters, drivers, the NU-TANG way. Prompt delivery. Send for prices—or send tools for repair. All work guaranteed.

NO WELDING!

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Mfrs. of Por-Matic air operated drilling fixture.
Drill bushings for same in stock.

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Popular package 8-oz. can fitted with Bakelite cap holding soft-hair brush for applying right at bench; metal surface ready for layout in a few minutes. The dark blue background makes the scribed lines show up in sharp relief, prevents metal glare. Increases efficiency and accuracy.

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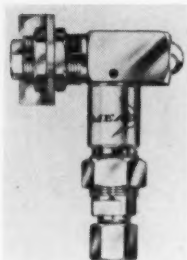
INTERLOCK LIMIT VALVE

A pneumatic pilot actuator that bleeds only enough air to shift a master valve before closing itself automatically has been introduced by Mead Specialties Co., 4114 North Knox Ave., Dept. 2541, Chicago, Ill.

Designated the No. 408 Interlock Limit Valve, the new component actuates differential pressure master valves of the pilot bleed type. Bleed duration may be varied to meet changing circuit requirements.

Mead engineers also point out that flow direction may be changed by another limit valve even while the No. 408 remains depressed. Consequently, the unit finds applications in circuits that call for one limit valve plunger to stay depressed throughout a series of operating cycles.

For more data circle 155 on Postpaid Card



Mead No. 408 Interlocking Limit Valve

DUAL SPINDLE GUN-DRILLING POWER UNIT

Drillmation Co., Inc., 6500 E. Eleven Mile Rd., Center Line, Mich., recently introduced a new Dual Spindle Boremotion Gun-Drilling Power Unit that is said to cut production time in half on certain operations. Workpieces that will lend themselves to close cen-

Every Plant needs *(at least one)*

Gusher TANK UNIT

WRITE FOR FREE GUSHER TANK UNIT BULLETIN.



Gusher Tank Units are precision built, efficient Coolant systems that may be used on any machine tool. Fully portable Gusher Tank Units can be moved from machine to machine, and come in many sizes and H.P.

Gusher Coolant Pumps are also available in a full line of O.E.M. Units.

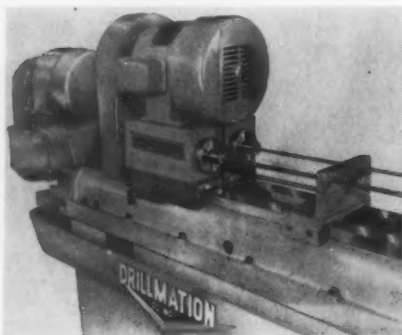
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- MOLTEN METAL PUMPS

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new equipment . . .



Borematon "Dual" Gun Drilling Power Unit

ter fixturing are ideal for this type of set-up.

Finished holes can be drilled from solid materials—in one pass—on a production basis. Diameter to length ratios as high as 288 to 1 are possible

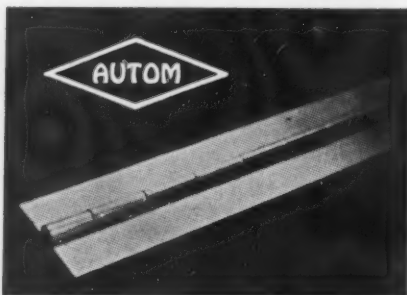
with a minimum runout of 0.0003 per inch. Ideal for production, these units readily adapt to one-of-a-kind or semi-production work, with both or one spindle operating.

The Borematon "Dual" is available with hydraulic or "positive drive" mechanical transmission on the 12 and 24 inch strokes. A mechanical transmission is mandatory for the longer 36, 48 and 60 inch units. The "positive drive" feed rate will not vary once set, even when drilling through hard or soft spots. Surge is completely eliminated, prolonging tool life and assuring accurate holes each and every pass. For more data circle 156 on Postpaid Card

★ modern machine shop ★

RIISING BLOCKS

The Brown & Sharpe Mfg. Co., 235 Provanade St., Providence, R. I., has introduced an aid called Flame-Clear Rising Blocks. These cast-iron, bee-



CONTINUOUS HINGES

SPECIFICATIONS

Open width $\frac{3}{4}$ " to 12"
Gage Material .040 to .187"
Pin Diameter .093" to $\frac{1}{2}$ "
Lengths to 144"

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& MFG. CO.**

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266 MODERN MACHINE SHOP

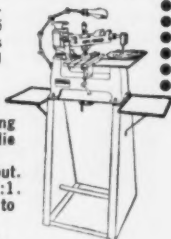
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in steel, other metals and plastics

Use the LOW COST precision-built Preis Panto 3D-5 Engraving Machine. Does both 2 and 3 dimensional engraving effortlessly.

- Reversible spindle for enlarging or reducing from a model, die or sample.
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- Reduction ratio range: 1.5:1 to 7:1.
- Four spindle speeds—7,000 to 18,000 RPM.
- Micrometer adjustment collar.
- Provided complete with floor stand and work tables.



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Write for complete details and prices. For immediate attention write directly to manufacturer below. Ask for nearest representative.

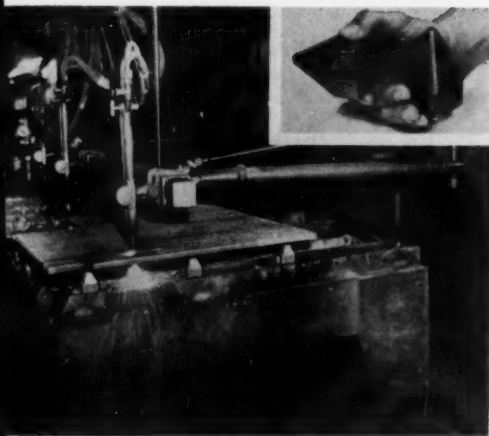
H. P. PREIS ENGRAVING MACHINE CO.

657 U.S. Route 22,

Hillside, N. J.

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June, 1961



View of Flame-Clear Rising Blocks at work

hive shaped blocks fit onto cross supports of any flame cutting table, thereby holding the steel plate clear of table and preventing the flame from cutting and damaging table bed.

Because cast-iron does not cut readily, these blocks have greater flame resistance and longer life. They may be arranged on cutting table supports according to pattern of cut, in seconds. Flame-Clear Blocks give a much firmer, more uniform working surface. They prevent distortion, hold heavy plate or thin sections, prevent "fall-away" of finished piece and reduce blow back. Blocks come in two "standard" slot sizes, 5/16 and 3/8 inch. Special blocks can be made for any application.

For more data circle 157 on Postpaid Card

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HYDRAULIC OVERLOAD PITMAN

The Dayton Rogers Mfg. Co., Minneapolis 7, Minnesota, has introduced a Hydraulic Overload Pitman which can be used on practically any power press. A few of the applications are:



Mahr

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**STAND
\$10.00**

ELIMINATE "FEEL"

INDICATING MICROMETER - COMPARATOR
Catalog No. 40 SF 0-1" Range
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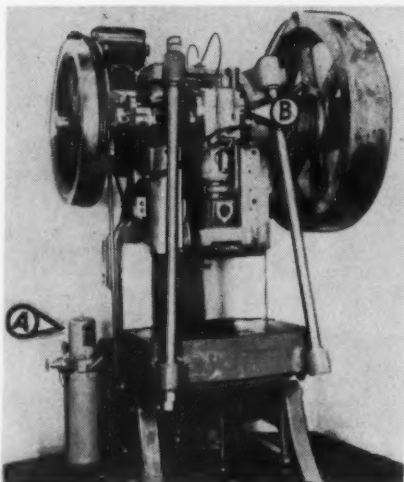
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new equipment . . .

briquetting, coining, embossing, marking, pressing, riveting, sizing, stenciling, staking, sub-assembly and swaging operations.

The equipment is provided with a pressure pump (A). The pitman or strap in the average power press is replaced by the Hydraulic Overload Pitman (B). It is easily installed on any power press, and will definitely eliminate any damage to the press, crank or frame. The calibrated relief valve can be set at any desired working tonnage for the protection of the maximum press capacity to protect a given set of tools or dies.

The pneumatic pumping unit (A) keeps a constant oil pressure on the pitman cylinder (B). This keeps the pitman precharged to the desired working pressure at all times. The relief valve is pneumatically control-



Dayton Rogers Hydraulic Overload Pitman

led by an automatic regulator and gauge, thus assuring accurate precision working tonnage at all times. For more data circle 158 on Postpaid Card

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OSCILLATING ELECTROLYTIC GRINDERS

Hammond Machinery Builders, Inc., 1615 Douglas Ave., Kalamazoo, Mich., has announced additions to the line of Hammond Oscillating Electrolytic Grinders, which include Models EGD 12 and 14 with duplex in-feed tables. These models are especially

JIG GRINDING and JIG BORING to your specification

At your disposal: Our sub-contract jig boring department, one of the best equipped in the East

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QUICK SURE GRIP...

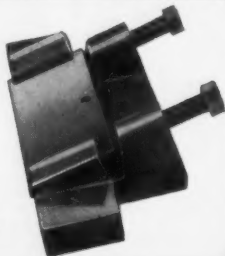
FOR ANY WORK ON ANY MACHINE TABLE

Original HART DIVIDED MACHINE VISE JAWS

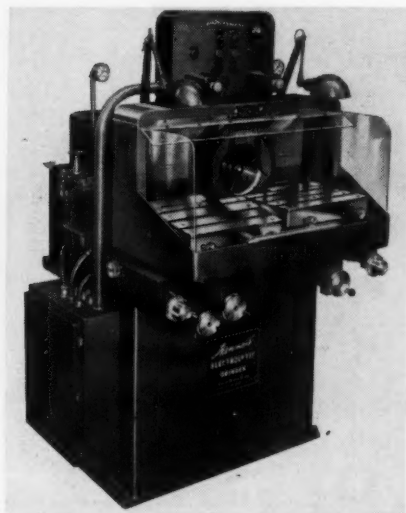
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WALTER W. FIELD & SON, INC.

660 Arsenal St., Watertown 72, Mass.



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View of Hammond Model EGD12 Electrolytic Oscillating Grinder with duplex tables

built for electrolytic grinding of steel and super alloy parts as well as carbide tools. Electrolytic grinding with these machines is burrless, free from metallurgical damage and offers outstanding savings in grinding wheel costs.

The Models EGD 12 and 14 accommodate 12 and 14 inch diameter wheels, respectively, and are built for automatic pushbutton, high production service.

For more data circle 159 on Postpaid Card

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SMALL BORING BARS AVAILABLE IN FIVE SIZES

Kendex BB-7000 K-Bars, small boring bars with solid Kennametal shanks for rigidity three times that of steel, have been announced by Kennametal Inc., Latrobe, Pa. Five sizes of these K-Bars, with diameters of $\frac{3}{8}$, $\frac{1}{2}$, $\frac{5}{8}$, $\frac{3}{4}$, and 1 inch, supplement Kennametal's Style BB-5000 Kendex adjust-

June, 1961

If you want to take

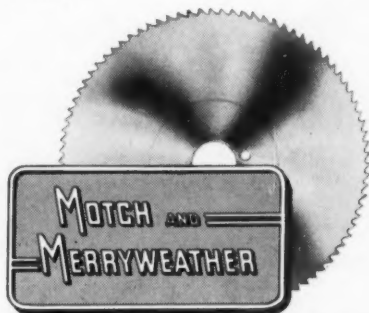


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big
bite

you've
got to use
the right teeth!

Check M&M for FIRST Quality RELIABILITY DEPENDABLE SERVICE

On all circular saw blades to cut
Steel—Aluminum—Soft Metals,
Plastics etc., cleaner—faster—
better!



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National Distribution and Service

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MODERN MACHINE SHOP 269

new equipment . . .



Five sizes of Kendex BB-7000 K-Bars

able K-Bars of 1 inch to 2½ inch diameters. Respective lengths of the small BB-7000 K-Bars are 6, 8, 10, and 12 inches. Standard triangular Kendex inserts and chip breakers are used with these bars.

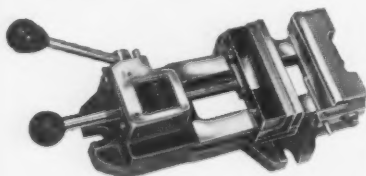
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LASSY *Rapid* **LOX**

INSTANT ACTION—"THRED LOCKED" VISE

Assures Powerful Dependable Clamping With
Instant Jaw Positioning.



Patented

- Jaw Pressure Is Selective and Repetitive.
- Ideal for Milling, Drilling, Grinding and Jig Boring—of One Piece or Thousands.

Order from Your Industrial Supplier
Mfg: Lassy Tool Co., Plainville, Conn.

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270 MODERN MACHINE SHOP



Tape Controlled Turret Drilling Machine

3-AXIS TAPE CONTROLLED TURRET DRILLS

Automatic control by tape of the depth of cut of each spindle, rapid traverse length, selection of feeds and speeds by tape are optional features offered on all Burgmaster 6 and 8 Spindle Tape Controlled Turret Drilling Machines. The Burg Tool Manufacturing Co., Inc., 15001 South Figueroa St., Box 311, Gardena, Calif., builder of these machines, uses 3-axis tape control systems to provide fully automatic machining within X-Y axis

TRIAL SAMPLE!

SPECIAL LUBRICANT EASES WORKING STAINLESS AND TOUGH METALS

New lubricant eases stamping and machining operations on the toughest metalworking jobs—takes the problems out of hard-to-work metals such as stainless, high carbon, high chrome, cast iron, monel, etc. **ANCHORLUBE** now used extensively for drilling, tapping, spot facing, counter-boring, milling, fly-cutting, seat forming, engraving, broaching, drawing, piercing, punching, hole extruding, etc. Send today for free trial sample and see for yourself how easy you can work the job with **ANCHORLUBE**.

ANCHOR CHEMICAL COMPANY

Dept. MM-6 • 10721 Briggs Road • Cleveland 11, Ohio
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June, 1961

table positioning, and simultaneous Z-axis control of tool penetration to suit the individual operation of each spindle.

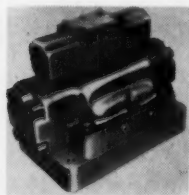
The design speeds setting up a job by eliminating manual pre-setting of mechanical depth stops furnished on the standard machine controls. By programming the rapid approach length and depth of each cut into the punched tape, the same spindle can be used to automatically machine holes of varying depths at different work positions.

For more data circle 161 on Postpaid Card

★ m m s ★

1 1/2 INCH 4-WAY CONTROL VALVES

A 1 1/2 inch 4-inch valve, rated at operating pressures to 5,000 p.s.i., has been announced by Denison Engineering Div., American Brake Shoe Co., 1254 Dublin Rd., Columbus, Ohio. This valve line, employing the



**Denison 1 1/2 Inch
4-Way Control Valve**

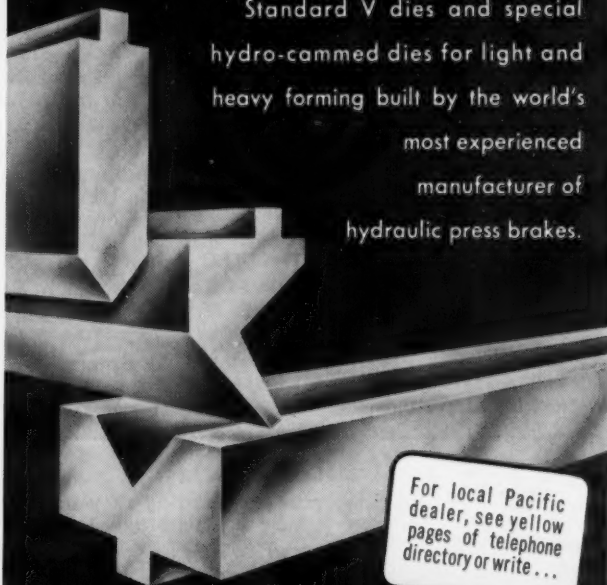
same basic design features found in the company's 3/4 inch valve line, can be operated by manual, mechanical or electrical means.

The valve is available as a thread, subplate or flange connected unit. Five different spools provide for open, closed or partially blocked flow path connections at flows up to 90 gallons per minute.

For more data circle 162 on Postpaid Card

Fast, nationwide service on **PRESS BRAKE DIES**

Standard V dies and special hydro-cammed dies for light and heavy forming built by the world's most experienced manufacturer of hydraulic press brakes.



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THREAD LUBRICANT IN TUBES

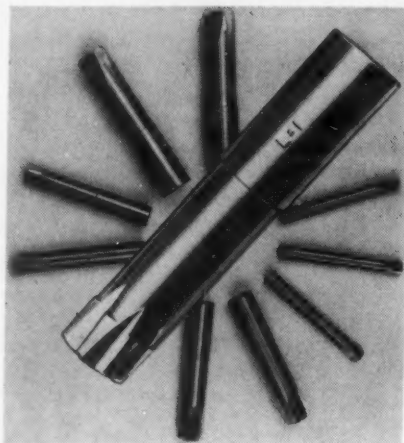
Parker Fittings & Hose Div., Parker-Hannifin Corp., 17325 Euclid Ave., Cleveland 12, Ohio, has announced that Ferulube, a thread lubricating compound packaged in one-pound cans, is available also in handy 8-ounce tubes. This compound reduces wrench torque in the make-up of "bite" type tube fittings such as Ferulok. Tests show that the high wrench torque normally required in assembly of large size fittings onto tubing may be reduced by as much as 75 percent through the proper use of Ferulube on the fitting threads and ferrule. The compound provides a protective film that prevents galling in stainless steel parts.

For more data circle 163 on Postpaid Card

★ modern machine shop ★

STUB REAMERS

An important advance in reamer design and production has been announced by Lavallee & Ide, Inc., Grape St., Chicopee, Mass. The HLB Economy Stub Reamer for automatic screw machines is available in 89 standard finished sizes from 1/16 to 1 inch, plus any intermediate special sizes. The HLB Stub Reamer features a short length flute design that assures



View shows Lavallee & Ide HLB Stub Reamer

cleaner holes and longer tool life, and effectively eliminates chatter and bell-mouth holes. In addition, rigid design is said to produce tolerances to 0.0002 inch.

This HLB Economy Stub Reamer combines top quality with low cost. The L&I design streamlines the shank diameter, so that production savings are realized in steel and stock removal with the smaller shank. Another factor in making the HLB a true economy reamer is the elimination of pin holes. The reamers, however, can be ordered with pin holes if desired by the user.

For more data circle 164 on Postpaid Card



MODEL 1025

Wesco COOLANT UNITS

The pump system at left is simple in design and low-priced . . . for jobs which circulate coolant containing grit and abrasives. Wesco mist coolant system at right operates from any air line. 25 lbs. to 150 lbs.

Write for complete details.



MODEL 100

Wesco TOOL, INC.

2820 SAN FERNANDO BLVD. • BURBANK, CALIFORNIA

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WAFERING AND LAPPING MACHINES

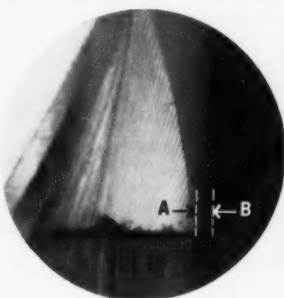
The Norton Co., Machine Tool Div., Worcester, Mass., has purchased the rights to, and will begin manufacturing, two machines used in the wafering and lapping of semiconductor materials used in solid state electronic devices such as transistors.

The Multi-Blade Wafering Machine is designed to cut approximately 300 wafers 0.010 inch thick from a single ingot in one operation. The Four-Way Lapping Machine produces ultra-thin wafers lapped to extremely close tolerances of thickness and parallelism. The wafering machine consists basically of a series of very thin steel blades, precisely spaced and under tension, which cut the ingot with a reciprocating motion. A slurry of silicon carbide or boron carbide acts as the cutting medium together with the thin steel blades.

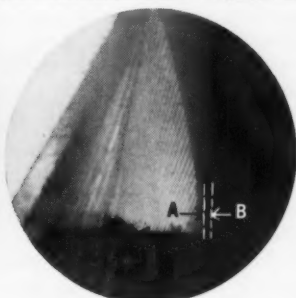
The wafering machine occupies a floor space only two by four feet and is driven by a 1/4 h.p. motor operating from any 110 volt, A. C. power source.

Because the operation is automatic, one operator can tend several machines. The blades are 0.008 inch thick or less thereby cutting a narrower kerf, or slot. The saving in material is the most important single advantage of the machine.

The lapping machine is a table top sized machine, about two feet in diameter which also operates from a 1/4 h.p. motor from any 110 volt a.c. power source. Its unique design in-



Excessive runout of end mill turning in average adapter shows up as variation in position of one flute (A) and others (B), in photograph.



B&S adapter turns same end mill with much less runout, as indicated by almost exact coincidence of one flute (A) and others (B).

"Stop-Action" Camera shows why B&S Adapters give you longer cutter life

Less runout means less "wear out!"

That's why your cutters last longer, when held in B&S adapters, than when held in other brands.

Brown & Sharpe *guarantees* low runout — within .0005", at the adapter mouth — .0015", 6" out.

Send for new B&S Catalog Supplement 37A, showing cutter-saving, work-saving adapters. 76 brand new items listed. Brown & Sharpe Mfg. Co., Providence 1, R. I.

Brown & Sharpe
PRECISION CENTER

For more data circle 558 on Postpaid Card



new equipment . . .

suress stress free lapping, an important feature in handling very thin and brittle materials. There are two models of this machine, one handling work as thin as 0.006 inch and the other designed for lapping to 0.003 inch. Wafer breakage due to lapping is practically eliminated. Irregular or broken wafers can be lapped in the machine without danger of their sliding under the carriers and scratching other wafers being lapped.

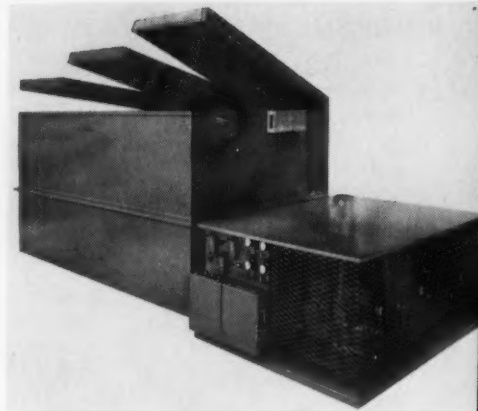
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LOW TEMPERATURE PROCESSING UNIT

An unusually large size, low temperature chamber designed specifically for the metallurgical processing of ferrous and non-ferrous aircraft materials has been built and is now being marketed by Cincinnati Sub-Zero Products, 3930 Reading Road, Cincinnati 29, Ohio. The chamber of this unit is 120 inches long, 60 inches wide, and 60 inches deep and constructed of 302-2B stainless steel.

The new Sub-Zero chilling unit is designed for continuous operation to maintain minus 110 degrees F. at ambient temperatures of 110 degrees F. Pull down with load is said to be accomplished within two hours. Full



Sub-Zero Low Temperature Processing Unit

load is considered at 1000 pounds of sheet parts having nominal section thickness of $\frac{1}{8}$ inch.

Air circulation is accomplished by means of two 16 inch diameter fans. Easy access is provided through the use of three hydraulically operated, full opening lids.

For more data circle 166 on Postpaid Card

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AIR POWER CYLINDERS

A line of general purpose air power cylinders, the Series "C", has been announced by Hannifin Co., a division of Parker-Hannifin Corp., Dept. 160, 501 South Wolf Rd., Des Plaines, Ill.

READING BENCH KEYSEATER

Portable — move directly to job; a time saver for both small and large shops.

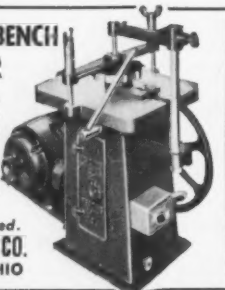
$3\frac{3}{4}$ " stroke; adaptable for other work.

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Good dealers wanted.

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274 MODERN MACHINE SHOP

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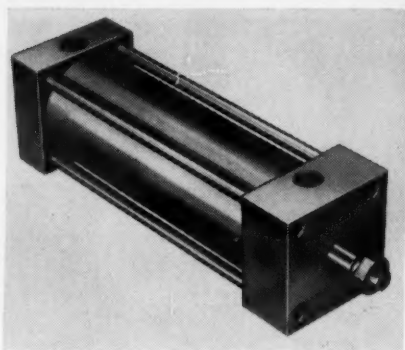
- Jeweled and Shock Proof
- Reversible • Sensitive Action (Swiss Type) • Satin Chrome Finish • Movable Bezel • Movable Non-Slip Friction Feeler • Large ($1\frac{1}{16}$ " dia.) Easy To Read Dial



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June, 1961



View shows Series "C" air power cylinder

The 200 p.s.i. maximum air cylinder is available in $1\frac{1}{4}$, $1\frac{3}{4}$, $2\frac{1}{2}$, $3\frac{5}{8}$ and $4\frac{1}{2}$ inch bore sizes with standard strokes to 20 inches. Single and double rod end models are offered. Floating cushions designed to reduce impact of stroke can be furnished when ordered, or added in the field without increasing overall length.

One compact design provides three basic mounting positions; side, cap end or head end. Four mounting attachments can be supplied if desired. Friction is minimized by an oil impregnated bronze rod bushing which keeps rod constantly lubricated. Hannifin's exclusive Wiperseal serves as rod wiper and pressure adjusted sealing element. One piece non-score piston construction eliminates metal-to-metal contact on cylinder body and stroke ends.

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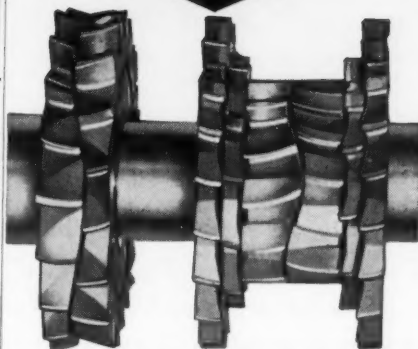
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PISTON ROD ENDS

The double-length piston rod end style "2L" is now offered as an optional standard on Miller Air and Hydraulic Cylinders by the Miller Fluid Power Div., Flick-Reedy Corp., 7N023 York Rd., Bensenville, Ill. Whereas the Miller standard style

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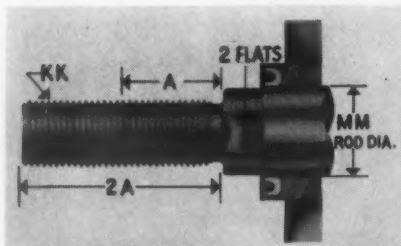
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MODERN MACHINE SHOP 275

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View of Miller Style "2L" Piston Rod End

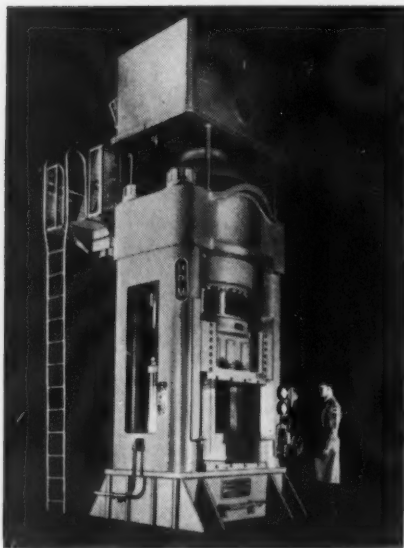
No. 2 piston rod end is threaded on an "A" length turn down section, the optional style 2L is threaded on a "2A" length turn down section. Thus, it provides twice the metal and twice the number of threads for securing attachments to the rod end.

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1500-TON HYDRAULIC PRESS

A 1500-ton hydraulic Fastraverse press custom-built by H-P-M Div., Koehring Co., Mount Gilead, Ohio, has been shipped to a large company specializing in the manufacture of malleable iron castings for the automotive industries. With this press, castings are precision straightened in matched dies. The press has a pressing area of 48 by 48 inches; a 36 inch



View of H-P-M Hydraulic Fastraverse Press

stroke; and 48 inch daylight between bolsters. The H-P-M control system provides means for operating the press either semi-automatic or manually. Change-over from one mode of operation to the other may be made in an instant without stopping the press.

An emergency reverse pushbutton, which if momentarily depressed during the forward press travel, will cause the press slide to reverse immediately without completing the cycle. A safety control automatically prevents the

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ram from dropping in the event of power failure or loss of pilot pressure.

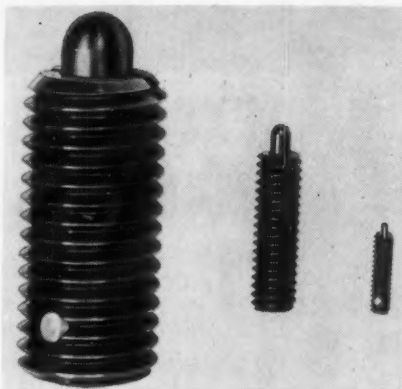
The H-P-M closed-circuit operating system is powered by a 50 h.p. electric motor.

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SELF-LOCKING SPRING PLUNGERS

Harco Engineering, 12092 Woodbine Ave., Detroit 39, Mich., has incorporated nylon pellets in its complete line of spring plungers for use in dies, jigs, fixtures and detents. When a spring plunger is in place, compression of the nylon pellet, called "Nylock," creates a spring-like wedging action which locks the mated threads together. The Nylock inserts eliminate the need for set screws or other methods of locking spring plungers. The consistent, self-locking torque of Nylock inserts permits quick, easy



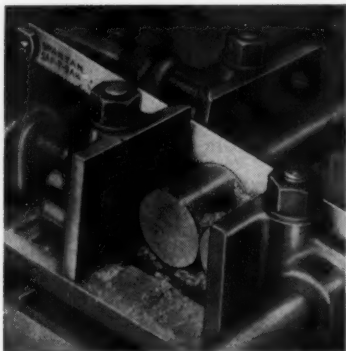
View of Harco Self-Locking Spring Plungers

assembly and a positive lock that is vibration-proof.

Harco Spring Plungers are available in thread sizes from 6-32 through 1 inch-8.

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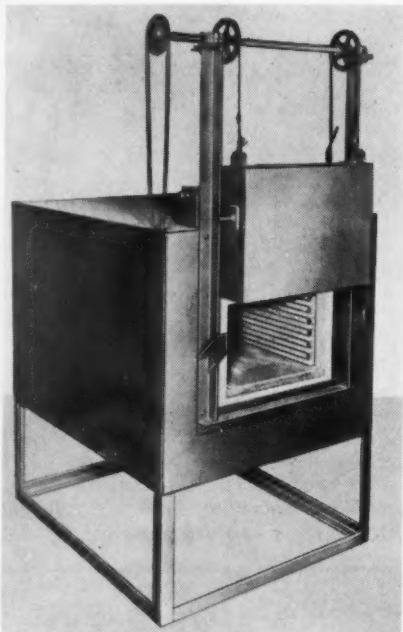
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View shows Lucifer Series 5055 Furnace

HEAT TREATING FURNACES

Lucifer Furnaces, Inc., Neshaminy, Pa., has introduced a series of seven furnaces, which are used for hardening, annealing, drawing and preheating. The 5055 Series furnaces are of box-type construction with chamber temperatures of 2,000 and 2,300 degrees Fahrenheit.

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NOTICE

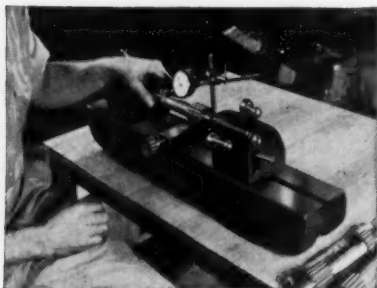
The price of the ASM Metals Handbook, 8th Edition, Vol. 1, "Properties and Selection of Metals," as described on Page 121 of the May 1961 issue, is \$30.00.

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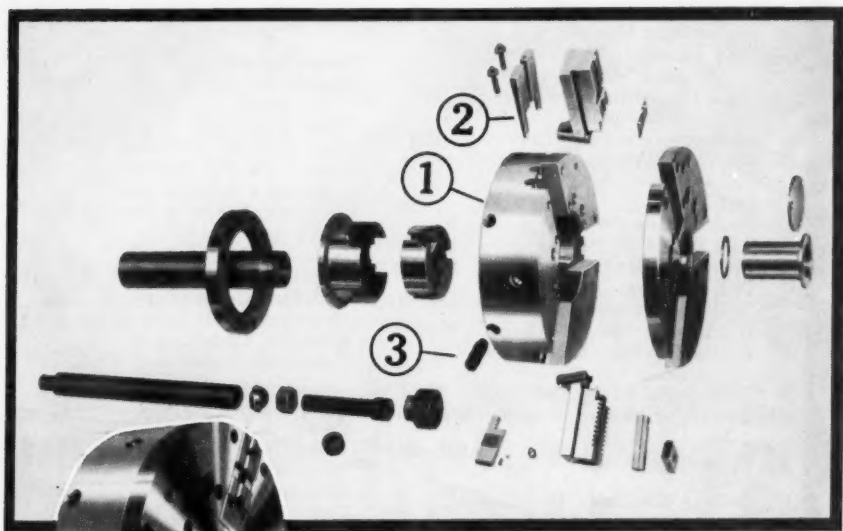
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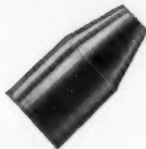
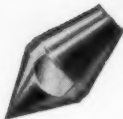
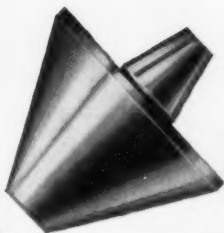
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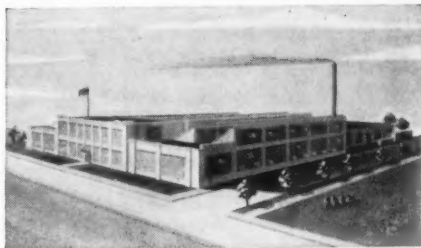
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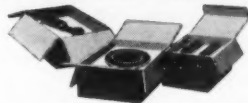
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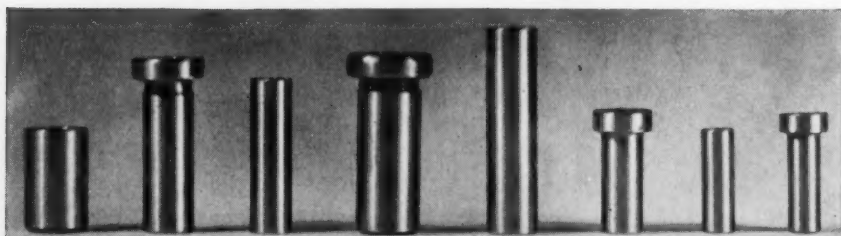
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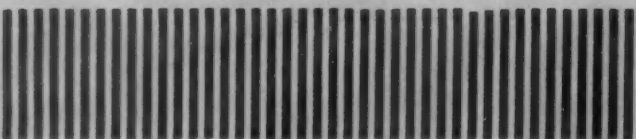
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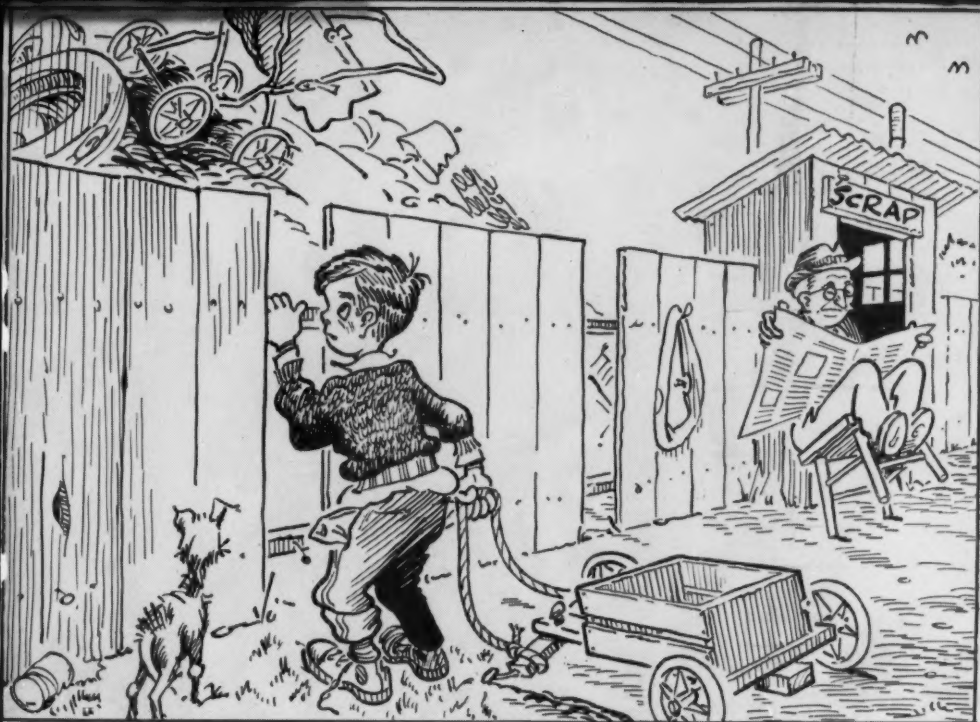
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